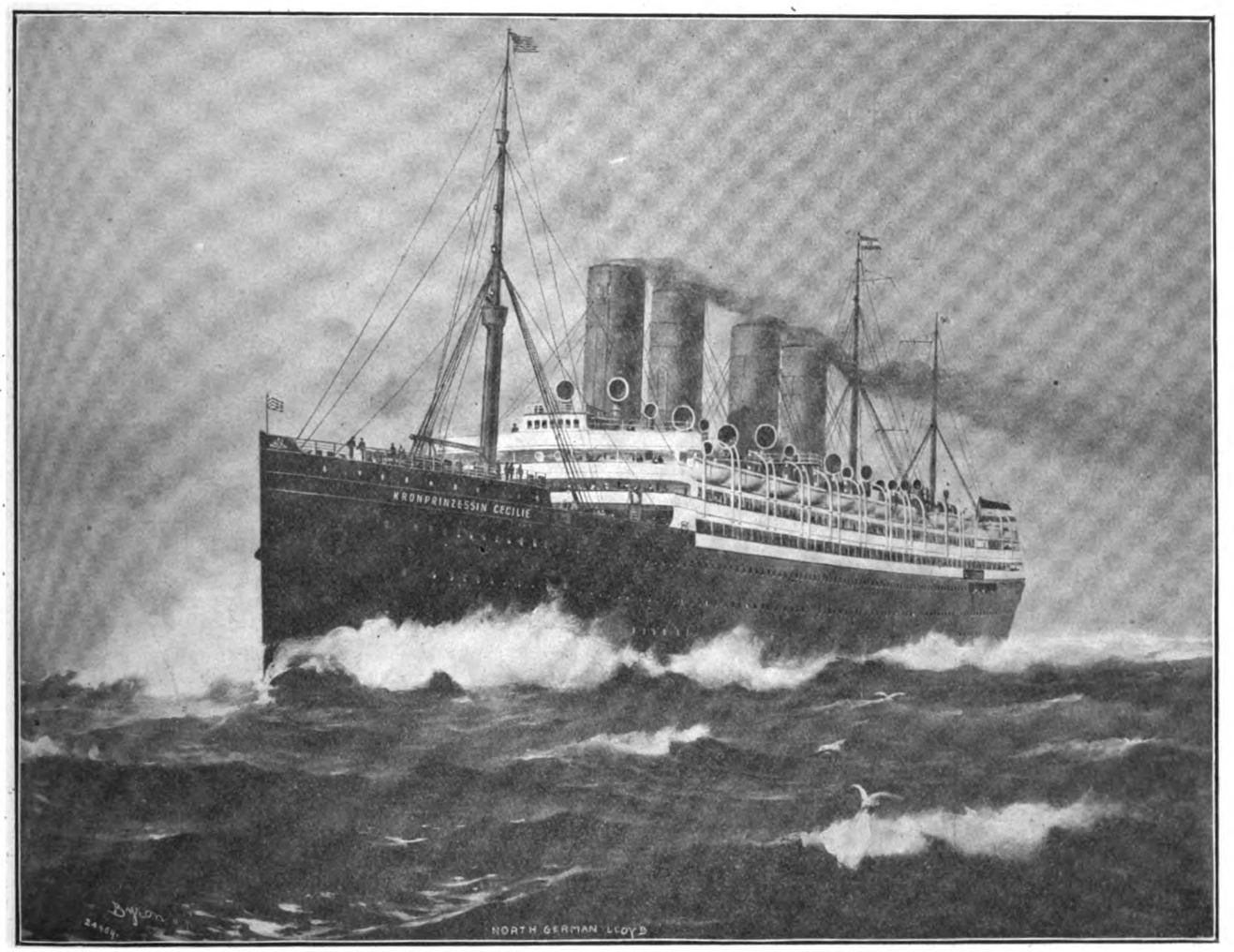
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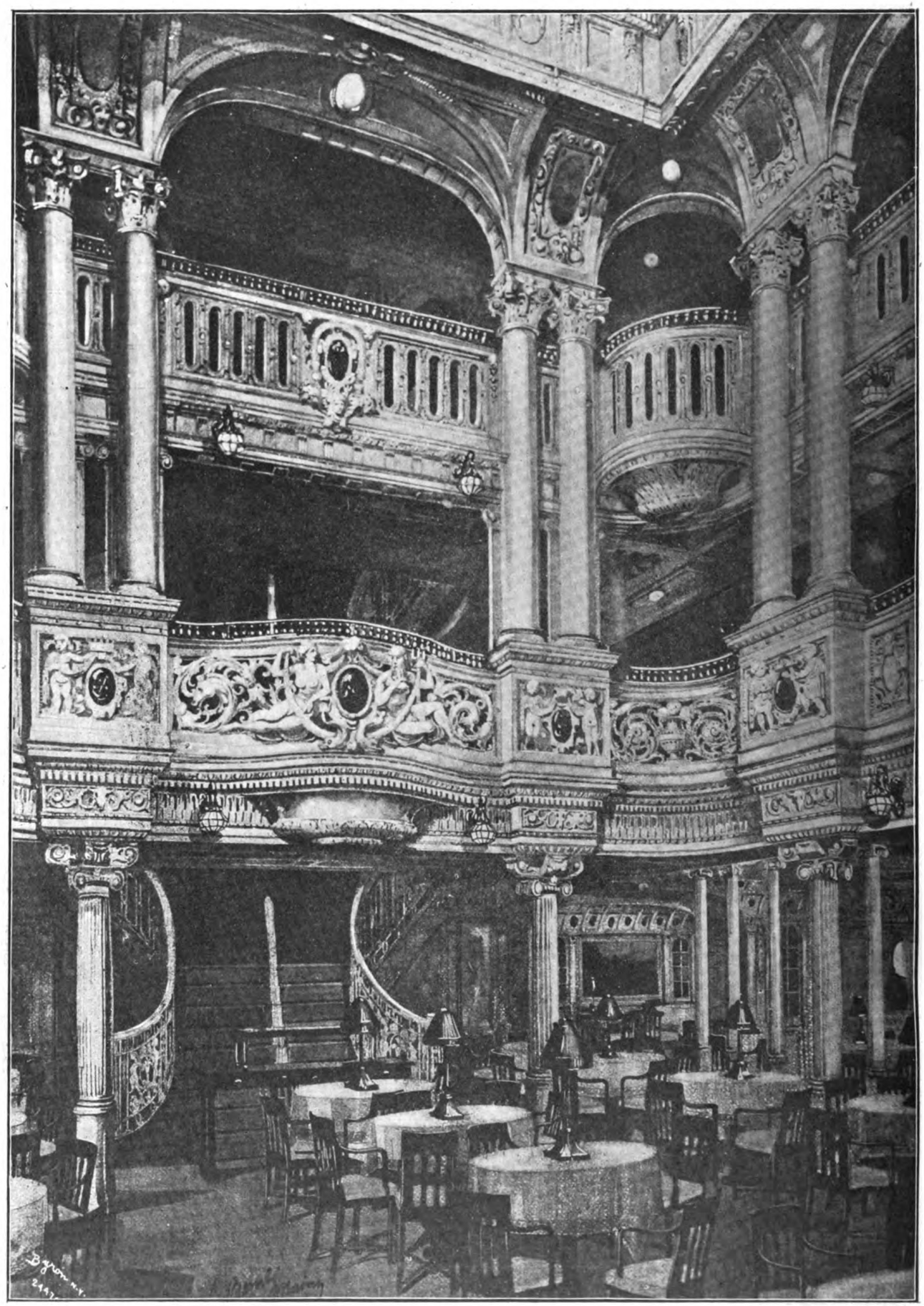
THE KRONPRINZESSIN CECILIE OF THE NORTH GERMAN LLOYD STEAMSHIP CO.'S FLEET.

KRONPRINZESSIN CECILIE.

The twin-screw express steamship Kronprinzessin Cecilie ("Crown Princess Cecilie"), is a sister vessel of steamship Kaiser Wilhelm II, which was built in 1903, and was constructed in the same yard—that of the Vulcan company at Stettin, Germany.

The dimensions of the Kronprinzessin Cecilie are: Length, 706 ft.; beam, 72 ft.; depth, 44 ft. 2 in.; the displacement, 26,000 tons, and the registered tonnage, 20,000 tons. Her weight on launching was 11,200 tons. The steamer is built of the best German steel, and in accordance with the rules and regulations of the highest type classified by the Germanic Lloyd. She has a double bottom, which is divided into twenty-six watertight compartments extending over the entire length of the vessel. Seventeen watertight transverse bulkheads, of which sixteen extend to the upper deck and one to the main deck, and a bulkhead

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A PART OF THE SALOON OF THE KRONPRINZESSIN CECILIE. THIS PICTURE AND THAT ON THE OPPOSITE PAGE ARE TRIUMPHS OF DECORATIVE EFFECT ABOARD STEAMSHIPS.

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FIRST CABIN SMOKING ROOM OF THE KRONPRINZESSIN CECILIE.

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between the starboard and port engine rooms divide the hull into twenty watertight compartments, of which two adjoining compartments could be filled without affecting the flotation of the vessel.

Water entering the hull can be expelled by four centrifugal pumps, four engine pumps, four steam pumps, and five duplex pumps, which are able to dispose of 5,000 tons of water in one hour. Twenty-four bulkhead doors are provided with the Lloyd-Stone-patent-closing-device, which is operated from the bridge. In the chart room on the bridge a plan of the vessel shows by a system of colored lights what watertight doors are closed and what doors are open.

To guard against the danger of fire, the steamer is equipped with three different fire alarm sysetms: One leading to the various quarters in which the crew are housed; another one with a complete set of bells for the various other parts of the steamer, and seventeen fire alarm boxes on all decks from which an alarm can be sent.

Twenty-eight life boats, eight of which are semi-collpsible, are carried on the boat deck on which four steam winches are located for the purpose of launching them.

Each one of the three anchors on the forecastle weighs 15,000 lbs., and the total length of anchor chains is 2,460 ft.

The long distance wireless system is installed on this steamer, rendering it possible to remain in touch with land on one side or the other of the Atlantic during the whole trip across.

The Kronprinzessin Cecilie is provided with four steel decks below the upper deck. Above that deck there is a spar deck running from fore to aft, which serves as a promenade deck. Upon this, a midshiphouse is erected, 443 ft. in length and 53 ft in breadth, with a deckhouse aft 111 ft. in length.

Another or upper promenade deck, 535 ft. in length, follows above the lower promenade deck; and on this upper promenade deck again there are two deck houses, one 436 ft. and the other 26 ft. in length. The boat deck or awning deck extends over these two deck houses to the extent of 451 ft. and 59 ft. respectively. The construction of the steamer shows, therefore, two comfortable and protected promenade decks on which passengers can sit or walk, sheltered from the weather.

The crew consists of 679 persons, of which 24 are officers; 61 engineers, oilers and electricians; 231 firemen and coal passers; 229 stewards and stewardesses; 33 pantrymen and scullerymen; 33 cooks, bakers and butchers; nine barbers, hair dressers, booksellers and baggagemasters; 59 quartermasters, boatswains, sailmakers and sailors.

The accommodations for passengers consist of 287 rooms in the first cabin, 109 rooms in the second cabin, and seven roomy compartments for the steerage passengers.

The first cabin rooms are situated upon the upper and lower promenade decks, the upper and the main deck; and, besides the regular staterooms, the steamer contains two imperial suites, consisting of a parlor, dining room, bed room and bath room with toilet; eight other suites, consisting of parlor, bed room and bath room with toilet, and twelve cabines de luxe, consisting of large bed room and adjoining private bath room with toilet. All the regular staterooms, as well as the suites and cabines de luxe are provided with every luxury and comfort. Many of the rooms are arranged for one passenger only.

The dining room is surmounted by a skylight which extends through four decks above the dining room, and in the construction of which Florentine Renaissance has been adopted in a white tone, richly covered with ornaments. Sixteen pillars carry a dome with a glass roof which cuts off the skylight at the drawing room level above the dining room. Behind the pillars, the balustrade of the second deck is visible, projecting in the corners in pulpit form. The carved lower balustrade shows two reclining figures in the middle of each of the four sides, containing the busts of the crown princess and the crown prince and their coat of arms in bronze relief. The sides of the dining room are partly ornamented with paintings showing landscapes, or scenes from Mecklenburg, the home of the crown princess, and covered with blue silk tapestries. The floor of the dining room is provided with rubber tiling. The afterpart of the dining room shows a staircase in bronze and wrought iron, which leads to the upper decks. As the skylight is white in tone and the passageways around it on the upper decks of dark mahogany, the skylight will show very advantageously against the dark background. The dining room of the Kronprinzessin Cecilie will contain 76 small round tables for two, five and seven persons, instead of the long tables formerly in use, on which the passengers will be served as in the restaurant of a large hotel on shore—not at a fixed hour as heretofore, but between certain hours. They can engage a table for their party and select an a la carte dinner, if they so desire, without extra charge, instead of the regular table d'hote dinner—an innovation which is a great boon to the traveling public.

A children's dining room has been provided on the Kronprinzessin Cecilie on the deck above the regular dining room. The lower part of the walls of this little dining room is covered with dark blue tapestry, the upper part showing pictures of scenes from childhood life, together with reliefs from well-known fairly tales.

The steamer is provided with a bookshop containing the latest publications in magazines and other literature.

The smoking room is treated in the modern Roman style with a central dome supporting a glass roof. The larger part of the smoking room is decorated in white, with leather tapestry; the seats, chairs and sofas are covered with greenish-blue leather; the floor with rubber tiles. The pictures show scenes from the home of the crown princess—Mecklenburg.

On the upper promenade deck is situated a music room, decorated in Empire style, the walls covered with red silk tapestry. Chairs and carpets match this color. The forward wall of the music room contains a life-size oil painting of the German crown princess.

The reading room, library and writing room is forward of the music room, and shows the same character. The furniture is of old mahogany, covered with blue gobelin, the walls decorated in white.

The arrangement of Vienna cafes, when introduced on the Kaiser Wilhelm II, proved to be so popular that it was also adopted on the new express steamship of the North German Lloyd, the Kronprinzessin Cecilie—a cafe for smokers and one for ladies being provided on the awning deck. Besides coffees and liqueurs, pastry, etc., which is served in these Vienna cafes, hot dishes are also obtainable in the cafe for smokers, which has an open air attachment in which passengers can sit at small tables, enjoying the fresh air and the beautiful view of the sea while taking their coffee. The cafe for smokers is decorated in Louis Seize style. The walls are in white enamel, the sofas and chairs covered with green pegamoid. The sides of the cafe are divided into niches that are provided with comfortable sofas, tables and chairs. The after-wall is entirely taken up by a large niche, containing sofa, small tables, and a sofa and chairs. The entrance to this cafe is by a stairway forward, to the left and right of which are buffets. The cafe itself is lighted by large square windows and skylights. At night artificial illumination is provided by a large number of artistic electric lights, distributed in the ceiling and in the niches. The out-door attachment of the smokers' cafe is decorated in Frisian style, the walls and ceiling in white enamel. Bronze doors with large openings, filled with glass, can be closed in very bad weather in order to insure complete protection.

The ladies Vienna cafe is also decorated in the style of Louis Seize. Panels

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of the wall are of citronwood, and decorated in the style of the boudoir of Queen Marie Antoinette in the Palace of Fontainebleau. The windows are hung with green silk curtains, and the chairs are covered with the same material.

Second class passengers are berthed in the after part of the lower, upper and main decks in rooms for two, three and four persons, and are comfortably cared for in a dining room containing 190 seats, a smoking room and a music room on the lower promenade deck.

The captain and officers are berthed in quarters on the bridge deck immediately under and aft of the bridge. The engineers and the engine force are berthed around and in the immediate neighborhood of the engine room.

The electrical current for illumination, heating, ventilation and other purposes, is furnished by five dynamos, of which four are situated aft of the main engine rooms between the propeller shafts, and the fifth on the main deck at one side of the engine room. Each of the five dynamos delivers a current of 1,000 amperes at 100 volts. The steamer is equipped with 3,100 electric lamps, and with electric bells in all first and second cabin rooms. The smoking rooms and cafes contain electric cigar lighters, and the staterooms are provided with plugs and connection for ventilating fans and curling irons. All outside rooms, as well as suites and cabines de luxe, are heated electrically.

Running warm water is provided in all rooms and bath rooms in the first cabin. A complete telephone line connects the bridge, the engine room and after bridge, the bridge and the lookout on the mast, the captain's room, all of the officers' and chief steward's rooms, and the pantry, and all suites and cabines de luxe.

The culinary arrangements on the Kronprinzessin Cecilie correspond in all particulars with the economic departments of a large first-class hotel. Each class and the crew have their own large kitchen arrangement. The kitchens for first and second class are situated in the neighborhood of the respective dining rooms and are equipped with an extensive range, with five steam cooking apparatus. The kitchen of the firemen and coal passers is equipped with four steam cooking apparatus, and the kitchen for the third class passengers with five of these apparatus. Two large double baking ovens and a confectioners' oven are provided in a separate space next to the kitchen for the first class. The pantries for the first, second and third class are arranged with every latest invention, such as plate warmers; coffee, tea, milk and chocolate urns; refrigerators; fresh water filters, egg boilers, etc.; besides which there are pantries provided for the smoking rooms of the first and second cabin, the two cafes, and one bar for each smoking room of the first and second cabin, and for the passengers of the third class. In the lower decks provision refrigerators, ice cellars and large provision rooms are situated.

The number of bath rooms for the first and second cabins is twenty-eight, not counting the private bath rooms attached to the suites and cabines de luxe.

In adopting for the new steamship Kronprinzessin Cecilie the old form of reciprocating engines instead of the new turbine type, the managers of the North German Lloyd were actuated by the fact that the turbine is still in its development, whereas the performances of the reciprocating engines are well tried and proved, —the "Kaiser Wilhelm II", for instance, having made forty-two round trips without being obliged to stop a single minute on account of her engines. The engines of the "Kronprinzessin Cecilie" develop 45,000 horsepower in four quadruple engines, of which two are installed tandem, one behind the other, on each shaft, with six cranks. Each of these double engines is placed in a separate watertight compartment enclosed by bulkheads in a fore and aft direction, as well as transversely. Through the balancing of the engine parts under the Schlick System, the vibrations have been reduced to a minimum. The number of cylinders of the four engines is sixteen—four high pressure, four first intermediate pressure, four second intermediate pressure, and four low pressure cylinders. The piston stroke is 5 ft. 11 in., and the diameter of the cylinders is 3 ft. 1 in., 4 ft. 1 in., 6 ft. 3 in., and 9 ft. 4 in. respectively, the high pressure cylinder being placed above the first intermediate pressure cylinder. The crank shafts are constructed entirely of nickel steel and have a diameter of 2 ft. 1 in., and the total length of the shafting is 236 ft., with a total weight of 240 tons. The two propellers are provided with four blades and are constructed of manganese bronze, the diameter of the propellers being twenty-four feet and their weight 79,200 lbs. The total number of main and auxiliary engines for the various purposes in use on the steamer is seventy-two, with a total number of 126 steam cylinders.

The steam for these enormous engines and auxiliary engines is produced in nineteen large cylindrical boilers, of which twelve are double and seven single boilers. The diameter of each of the boilers is seventeen ft., and the length of a double boiler is 20 ft. 10 in. The total number of fires is 124, requiring an enormous quantity of coal to furnish the necessary steam for the use of the engines. Eighty-one firemen and coal passers are busy in each watch of four hours, after which they enjoy eight hours rest. The ventilation for the boiler rooms is furnished by enormous ventilators, assisted by an extensive system of electrically driven fans. Instead of complaining of extensive heat, the firemen now, in the summer time, when it is too warm on deck, prefer the coolness of the well-ventilated boiler rooms. The height of each of the four smokestacks is 121 ft. above the grate bars; their width is 16½ ft.

The materials used in the construction of this steamer consisted of about 11,000 tons of steel; 700 tons of bolts and screws; 300 tons of cast and wrought iron; 42,000 cubic ft. of teakwood; 70,500 cubic ft. of Oregon and pitch pine, and 19,426 cubic ft. of pine.

END OF THE CONNECTICUT-LOUISIANA CONTEST.

After a year of controversy regarding the merits of the two systems of construction for vessels of the United States navy, viz.: in private yards or in government yards, it seems that the trials of the battleship Connecticut last week demonstrated the superiority of the private-built over the government-built battleship. The Louisiana was built by the Newport News Ship Building & Dry Dock Co., and on her trial trip she developed a speed of 18.23 knots, made on a four hours' continuous test, with her propellers making 127.68 revolutions per minute. The government-built ship, the Connecticut, made on her trials, a speed of 18.78 knots. The vessels are sister ships and thus afford an excellent chance for comparison. The navy department partisans point out that the Connecticut on this trial was carrying 350 tons more weight than was the Louisiana on her trial trip, causing her to draw five inches more water. Therefore, it is asserted that if allowances are made for these conditions, the Connecticut's performance is really superior. On the other hand, the private ship builders assert that the fact that the Louisiana had her trial when the ship was brand new, while the Connecticut had had a year's shaking down, confirms the superiority in speed of the Louisiana, the vessel built in a private yard.

The army transport Warren, which left San Francisco Aug. 3 for the Philippines with a large contingent of troops and passengers, was compelled by a breakdown of her machinery, to put back to that port when 80 miles out at sea. One of the condenser tubes was in such bad condition that salt water was running through and mixing with fresh water.

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OUR FOREIGN COMMERCE BY AMERICAN PORTS.

BY WALTER J. BALLARD.

According to the Bureau of Statistics, less than a dozen customs districts are credited with five-sixths of the entire foreign commerce of the United States in the fiscal year just closed.

They are approximately as follows:

New York	$1,480,000,000
Galveston	251,000,000
Boston	230,000,000
New Orleans	217,000,000
Philadelphia	174,000,000
Baltimore	145,000,000
San Francisco	90,000,000
Puget Sound	68,000,000
Savannah	66,000,000
Mobile	28,000,000
Chicago	25,000,000

In imports the order was: New York, Boston, Philadelphia, San Francisco, New Orleans, and Baltimore; and in exports, New York, Galveston, New Orleans, Baltimore, Boston, Philadelphia, Savannah, Puget Sound, Detroit, San Francisco, and Buffalo.

In 1897, 83½ per cent of our imports entered through Atlantic ports, but in 1907 the proportion so entering fell to 80 per cent. The export percentages in like manner dropped from 69 per cent in 1897 to 57 per cent in 1907.

Comparing 1907 with 1906, the imports show:

	Increase per cent
Pacific ports	40
Interior ports	20
Gulf ports	18
Atlantic ports	17
Northern border ports	12
Mexican border and lake ports	6

And in exports:

	Increase per cent
Gulf ports	30
Interior ports	24
Mexican border ports	17
Northern border and lake ports	12
Atlantic ports	1
	Decrease per cent
Pacific ports	10

This Pacific port's decrease in exports is owing to the loss of $14,000,000 in our exports to Asia in 1907, compared with those of 1906.

More striking figures of increases are before us if we compare the imports of 1907 with those of 1897, as follows:

INCREASE PER CENT IN 1907 OVER 1897.

Mexican border ports	337
Gulf ports	220
Interior ports	180
Northern border and lake ports	118
Pacific ports	111
Country as a whole	90

And in exports:

Northern border and lake ports	211
Mexican border	193
Gulf ports	163
Pacific ports	56
Atlantic ports	46
Country as a whole	80

In dollars the 1907-1897 comparison is:

1907 fiscal year.		Increase over 1897.
Boston—		
Imports	$128,000,000	$ 38,000,000
Exports	101,000,000	No change from 1906
New York—		
Imports	858,000,000	377,000,000
Exports	616,000,000	224,000,000
Philadelphia—		
Imports	80,000,000	32,000,000
Exports	94,000,000	47,000,000
Baltimore—		
Imports	39,000,000	28,000,000
Exports	100,000,000	14,000,000
Newport News—		
Imports	3,000,000	2,000,000
Exports	14,500,000	*7,500,000
Savannah—		
Imports	500,000	2,000,000
Exports	63,000,000	40,000,000
Galveston—		
Imports	7,000,000	6,000,000
Exports	244,000,000	156,000,000
New Orleans—		
Imports	17,000,000	29,000,000
Exports	171,000,000	70,000,000
Mobile —		
Exports	24,000,000	14,000,000
San Francisco—		
Imports	56,000,000	22,000,000
Exports	33,000,000	*7,000,000
Puget Sound—		
Imports	25,000,000	18,000,000
Exports	43,000,000	12,000,000

*Decrease.

The figures for Pacific Coast ports do not include all the business of those ports, because the shipments to and from Hawaii, which were included in our foreign trade figures in 1897, are not now so included, Hawaii having become a territory of the United States, and one of its customs districts. As a fact, $28,500,000 of our imports from, and $14,000,000 of our exports to, Hawaii pass through Pacific ports, adding that much to the overseas commerce of those ports, in addition to the figures credited above. San Francisco imports from Hawaii increased from $10,000,000 in 1897 to $16,000,000 in 1907, and her shipments thereto also increased from $4,000,000 to $11,000,000, while Puget Sound increased its shipments from $250,000 to $1,500,000.

The great gains made by southern ports are easily discernible in the above 1907 fiscal year schedule of our foreign commerce by ports.

IRON STEAMBOAT EARNINGS.

Comparison of receipts of the Iron Steamboat Co., of New Jersey, of the four best seasons from the opening of each to Aug. 1, from ticket sales, New York to Coney Island, shows:

	May.	June.	July.	Total.
1905	$7,307	$38,960	$78,050	$124,317
1906	7,622	51,313	68,307	127,242
1907	4,110	41,175	85,812	131,097
1892	2,789	31,993	79,158	113,940

The fare in 1905 was 25c; 1906, 35c; 1907, 40c; 1892, 50c.

The ticket sales to fishing banks, from beginning of each season to Aug. 1, 1904, were $38,256; 1905, $52,954; 1906, $52,054, and 1907, $51,594.

The Hamburg-American Steamship Co. is reported to be about to enter the passenger field at Boston and plans are believed to have been effected whereby some of the passenger steamships will be transferred to that route. This company already has established a prosperous freight business at this port.

MISCELLANEOUS ITEMS.

The Hamburg-American liner Kaiserin Auguste Victoria was recently in collision with the French sailing vessel Ville de Dijon July 27, during a heavy fog. The sailing vessel lost her bowsprit but the Kaiserin suffered no damage whatever.

The investigation held at Savannah, Ga., regarding the destruction by fire at sea of the Merchants' & Miners' steamer Allegheny, resulted in a summons to Capt. I. H. Freeman for trial August 13, to show cause why his license should not be suspended or revoked for alleged negligence, unskillfulness and endangering life. The investigation was conducted by Supervising Inspector Oast.

Work will shortly be begun in dredging in Bay Ridge and Red Hook channels in New York harbor under the direction of Lieut. Col. W. L. Marshall, government engineer. Bay Ridge channel is to be made 35 ft. deep at mean low water and 1,000 ft. wide from its lower end up to within 300 ft. of the Erie basin bulkhead, a length of about 17,500 ft. The same depth is to be extended along the east bank of the channel up to 28th street.

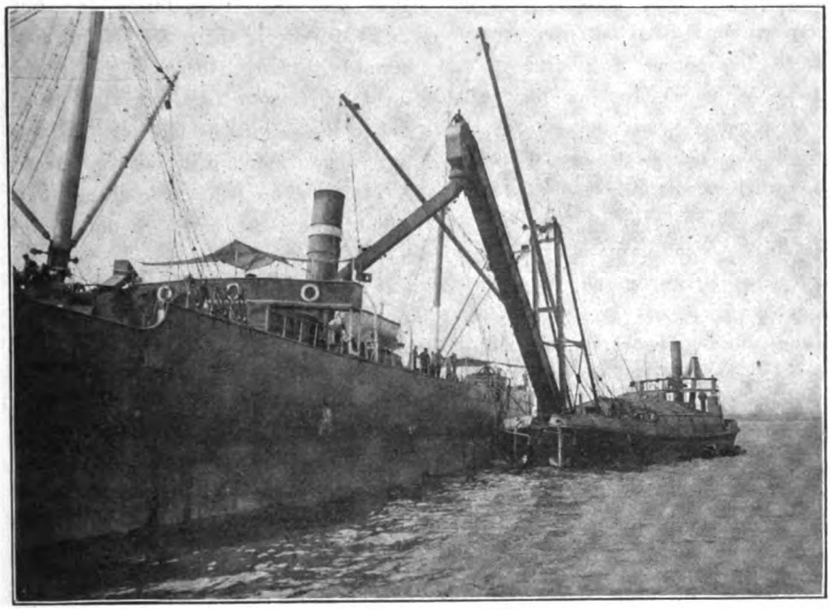
The Chicago, Milwaukee & St. Paul railroad is to have a fleet of nine large vessels plying between Seattle and the Orient when the extension of the road is finished in 1909, according to President E. J. Earling, of that company. A tentative agreement has been entered into with the Osaga Shosen Kaisha for the operation of the line. The nine steamships, each having a capacity of 12,000 tons, are at present under construction in Japan and the last of them is to be delivered not later than February, 1909.

The conference in regard to the installation of steam turbines on both of the large battleships recently contracted for has resulted in a decision to limit the experiment in the direction of turbines to one ship. The Delaware will therefore be provided with reciprocating engines. The decision turned on the question of economy of coal. No question of the cost of construction entered into the matter, but the idea that the radius of base and cruising endurance might not infrequently depend on an exotic coal pile representing great expenditure, acted as a powerful deterrent. The use of a battleship like the Delaware under turbine propulsion in the Philippines or anywhere in the Orient where coal represents an immense sum in original cost of the article and added freight is a problem that the board of construction was not prepared at this time to attempt to solve.

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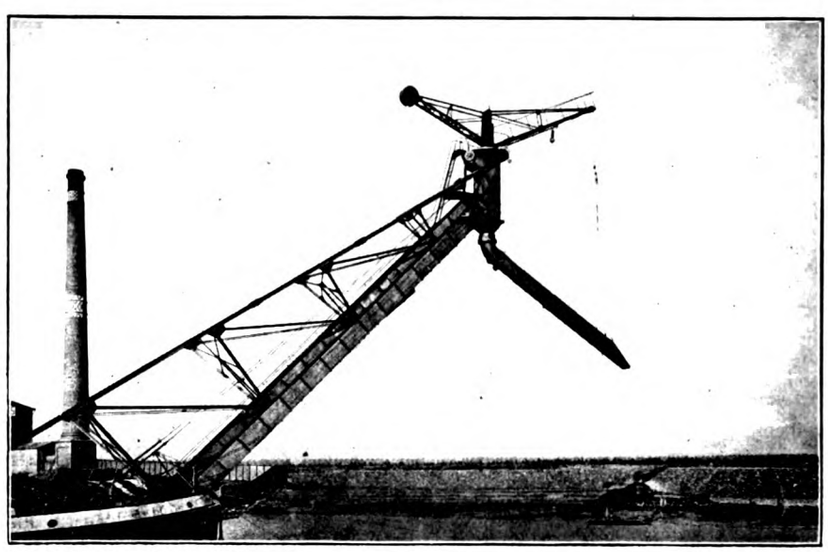
BARGES FOR SHIPMENT OF COAL AND ORE.

We are indebted to Messrs. Smulders, of Werf Lusto, Schiedam, Holland, for the accompanying illustrations showing a new type of vessel recently introduced and constructed by them for handling shipments of coal and ore. It is especially adapted for bunkering purposes, while ore can be dealt with with equal facility. The hull is divided into several compartments or pockets, which are funnel shaped, the slope being a little steeper than the natural angle of repose of the coal, so that no trimming is needed. These pockets can be discharged at will into a deep passage or tunnel, vertically sliding doors being fitted for the purpose. An endless conveyor runs from the latter end of the vessel and up to the top of the ladder which forms so conspicuous a feature in the bow, it being suitably guided for the purpose. The conveyor is a combination of the endless chain-tray type and the bucket type of conveyor. The sides of each section overlap those of the neighboring sections, while each section is also provided with a transverse plate, so that, when working on the slope of the ladder, the coal does practically rest in buckets. The conveyor chain is driven by a sprocket-wheel in the engine room at the after end of the vessel. It is carried by means of wheels on a double track, both in the tunnel and during its upward and downward journey in the ladder. The vessel not only supplies coal, but automatically registers the quantity at the same time. For this purpose there is placed between the last pocket and the foot of the ladder a self-registering weighing machine. This weighs the coal passing through without interrupting the delivery, and the quantity delivered can at any moment be read off. The capacity of the machine for weighing is two and a half times that of the delivery. This excess is allowed because the charge on the conveyor is not always equally proportioned, and it may be that the load for a time will be greatly in excess of the average. If the weighing machine were not equal to the full load at such times of excess, the quantity registered would be less than that actually delivered. The apparatus is guaranteed by the makers to weigh with only 1 per cent deviation from accuracy. At the top of the ladder is a receiving hopper, and to the bottom of this is fitted the discharging trunk or chute, which may be moved to any required direction, and which is telescopic, so that it may be lengthened or shortened at will.



BARGES FOR SHIPMENT OF COAL AND ORE—EARLIER DESIGN.

In the first design the guaranteed duty was 100 tons of coal put into the bunkers per hour, the ladder being at an angle of 45 deg., and the axle of the upper tumblers 59 ft. above water level. On trial, however, 140 tons per hour were easily delivered. The later vessels are larger and more powerful, with a crane fitted on the top of the chute for wo king same. The great advantage of the system is that the coal is put into the ship's bunkers through the deck opening without being exposed to the air, and therefore no coal dust is flying about; in fact, bunkering is quite a clean process. The wide spread of the elevator and the adjustment of the chute enable the bunkers on both port and starboard side to be reached without shifting the barge or the ship. This is a great convenience with ships lying against a quay; in fact, cargo can be discharged or shipped, and coal taken into bunkers at the same time, under circumstances where it would be impossible with the ordinary arrangements. The reach of the whole apparatus is such that steamers of large tonnage can be dealt with when light, and it is possible, when two ships are lying alongside each other against the quay, to coal the inside one by reaching over the deck of the other. Moreover, the movement of the coal is sufficient gradual for it not to be broken up, and a good deal of dust is avoided. The vessel is self propelled, being provided with twin screws.



BARGES FOR SHIPMENT OF COAL AND ORE—LATEST DESIGN.

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IMPROVEMENT OF WATERWAYS.

The United States is confronted with the problem of moving its coarse commodities. The commerce of the country has doubled within the past ten years, but railroad facilities have been increased only one-eighth in that time. Obviously there is congestion. There is but one solution of this problem of inland transportation, and that is the development of waterways. It is a mistake to suppose that the waterway is a competitor of the railway. It supplements and adds to rail transportation; it does not compete with it. The tonnage of the great lakes is enormous but were the lakes to dry up this tonnage would not be transferred to the railways. It would simply cease to exist, industry adapting itself to new conditions and not attempting to transport ore 1,000 miles to the furnaces. The real business of the railway is the movement of high class freight—freight which can afford to pay a reasonable sum for transportation. Coal and iron ore cannot be transported long distances on railways without multiplying their original cost many times; but articles produced from such raw material may be transported thousands upon thousands of miles and the cost of transportation equal but a small portion of their original cost. Economically considered, navigable waterways are but feeders of the great railway systems of the country. The general government should deal generously with waterway improvements because there is no form of investment that it makes that wins such large rewards and that distributes its dividends so widely.

The Inland Waterways Commission, appointed by President Roosevelt, will hold its first meeting in Cleveland on Saturday, Sept. 21, and will make an extended tour. The chairman of this commission is Hon. T. E. Burton, the other members being Senators Warner of Missouri and Newlands of Nevada; Senator Elect Bankhead of Alabama; General Alexander Mackenzie, chief of engineers; Gifford Pinchot of the forestry division; James Newell, chief engineer in the irrigation service; C. Knox Smith, bureau of corporations, and Dr. W. J. McGee of the government geological survey. This commission will first pay attention to the lakes and has arranged with Mr. Harry Coulby, president and general manager of the Pittsburg Steamship Co., for a steamer upon which to make a tour of the lakes. From the head of the lakes the commission will make a tour of the Mississippi valley and will in all probability have a preliminary report to make to congress at its next session.

LIFE SAVING SERVICE.

It is reliably reported from Washington that Secretary Cortelyou of the treasury department intends in his next annual report to ask for enabling legislation for the betterment of the life saving service. No department of the government has been so neglected as the life saving service. There are absolutely no atractions in the business. On the lakes especially the men are employed only during the season of navigation and are left to shift for themselves during the winter. Moreover, there are no ultimate rewards because there is no retirement or pension list If a man grows old in the service he is discharged and left to find a living elsewhere. Secretary Cortelyou believes that not only should they be better compensated but that there should be retirement for age or injury. Every person associated with shipping believes the same thing and it is hoped that Secretary Cortelyou will receive sufficient support to put the matter through.

CENTENNIAL OF STEAM NAVIGATION.

At 12:55 p. m. Saturday, August 17, there was nothing exceptional happening in New York harbor. The incoming liners, their decks swarming with immigrants bound for the land of plenty, crept slowly up the river and swung into their berths. The outgoing steamships formed a fleet extending from the Battery to Sandy Hook. Excursion and other pleasure craft, with flags flying, passed up and down the bay. Ferryboats crossed and recrossed the East and North Rivers, or ploughed their way to Staten Island. Heavy seagoing tugs churned past Fort Wadsworth, while farther inland their innumerable smaller sisters labored past the wharfs with heavily laden barges in tow or panted along the water front on their countless missions. Freighters of all sorts and sizes wormed their way through the general traffic and the dilapidated trampship occasionally lumbered along. The fact that anything unusual was about to happen might have been betrayed by the elaborate display of bunting on board-ship and the general air of expectancy of the crews.

At precisely 1 p. m. the deep roar of the horn on a liner lying at her wharf broke on the air, a long drawn out roar, to be immediately joined by the horns and whistles of all the craft on the rivers. The low far-reaching rumble, the loud wail of the siren, the piercing shriek, the staccatto bark, and even a chime here

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and there were at times distinguishable, to be lost again in the general effect of the choral. For thirty seconds the triumphant chorus swelled, then gradually the noise died out as the various craft withdrew from the choir, and all was as usual on the Hudson.

Simultaneous with the outbreak of the chorus in the harbor, the largest United States flag in existence was unfurled from the top of the steel framework of the forty-one-story Singer Building, five hundred feet above the level of the street. This flag is the property of the League of Peace, and has flown on some memorable occasions, particularly the time of the Columbian Expositions in 1893, when it floated at Atlantic Highlands. After the unfurling of the famous flag an informal reception was held in the Singer Company's offices by the League of Peace.

During the salutation, also, members of the Robert Fulton Memorial Association left the city on a steamboat of the Day Line, the course of the steamer being the course taken by the Clermont, the first steamboat to navigate the Hudson, on her maiden voyage one hundred years ago. As the steamer swung from the wharf the band was playing "Bonnie Doon", Robert Fulton's favorite song, and the bands on the passing steamers joined in the refrain.

It was a singularly fitting observance of the centennial of Fulton's triumph with the Clermont, and a well merited tribute to the little craft whose maiden trip was epoch-making in the history of navigation.

IRON SITUATION.

Dullness continues in pig iron and in the Cincinnati market the appearance of some reselling iron has had a depressing effect upon prices so that the general quotation of $19 to $19.50 Birmingham for No. 2 foundry spot iron is being made. Despite the extreme quiet of the iron market foundries appear busy and are urging deliveries on contracts. In finished lines the strong situation is holding up well. Structural material and merchant pipe particularly are enjoying a heavy trade. Fall business in wire products is very heavy and plates remain active with specifications very heavy, particularly from shipbuilding companies. Coke prices are firm but the old material market is entirely without support.

FREIGHT SITUATION.

Recovery from the late strike at the head of the lakes has not been so rapid as was expected. Affairs are not yet normal. There is considerable delay at upper and lower lake ports. Freighters have had to wait from three to four days to get cargoes with the result that harbors are crowded with waiting craft. Unloading is also slow at Lake Erie ports and the supply of cargoes is not good. Neither is coal coming forward as rapidly as shippers would like.

RELATIVE RIGHTS OF STEAM AND SAIL VESSELS.

The rules require that when a steam vessel and a sail vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sail vessel. While this rule is based upon the fact that a steam vessel is ordinarily more perfectly under command than a sail vessel, and more easily maneuvered, it still applies to cases where such is not the fact, as in the case of a steamer encumbered with a heavy or unwieldy tow, casting upon the steamer in such case special care to avoid dangerous proximity to an approaching sail vessel. Nor does the fact that the sail vessel is a pleasure craft lessen the obligation of the steam vessel.

If, owing to the condition of the weather or the darkness of the night, the shutting out of the lights of the sail vessel, or fluctuating lights, or from any other cause, the course of the sail vessel is in doubt, the steam vessel must slacken speed or stop and reverse until such course is ascertained. If she continues blindly under full speed under the same or a changed helm, she assumes the risk of a resulting collision, for the steam vessel should not unnecessarily change her helm when the course of the sail vessel is in doubt. But the steam vessel need not slacken speed or change her course when from the position and lights of the sail vessel she has no reasonable ground to apprehend a collision.

The rules provide that every vessel directed by the rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other. But these rules are not imperative, the steam vessel being required to take such precautions as are necessary under the circumstances.

From the moment the sail vessel is seen her course and movements must be watched with the greatest vigilance so as to be able to adopt such timely measures of precaution as will prevent collision. The steam vessel must keep off the course of the sail vessel if it is practically possible to do so; that is, if she can do so without collision with another vessel, running aground, or the like. Where she cannot obey the statutory rules without placing herself in serious peril she is bound to resort to all practical means before she is justified in disobeying the rules. The steamer has no right, by giving danger signals or the like, to compel the sail vessel to change her course where it is practicable for the steamer to avoid her.

The steam vessel must take the necessary measures of precaution in time to avoid the sail vessel, and she must slacken speed or stop and reverse if necessary. The steam vessel must not crowd on the course of the sail vessel, nor adopt a hazardous maneuver, but she must keep away by a safe margin, and give the sail vessel a wide berth when it can be done, so as to run no risk of error, or miscalculation, taking into consideration the course of navigation, the condition of wind and tide, the necessity of the sail vessel to go about at the end of her tack or to avoid obstructions or other vessels having the right of way or any conditions which make a change of course necessary, and to guard against the accidents and contingencies to which a sail vessel is liable, such as drifting, or yawing or losing the wind or shifting winds. Nor should she approach so closely as to cause apprehension of danger and a wrong maneuver on the part of the sail vessel as to avoid collision.

Where a sail vessel closehauled and a steam vessel approach so as to involve risk of collision, the rule requiring the sail vessel to keep her course, requires her to beat out her tack. Nothing but urgent necessity will excuse her luffing or coming about when approached by a steamer. She is not required to tack short on signal from the steam vessel when there is danger in so doing, nor need she remain in stays or overreach longer than usual when such measures are not apparently necessary to avoid a collision. However, a sail vessel beating in the vicinity of a steam vessel is not obliged to run out her tacks, provided her going about is not calculated to mislead or embarrass the steam vessel. Nor is she in fault in making a long sweeping turn in coming about on her tack, if no danger from the maneuver could be apprehended at the time it was attempted.

(To be Continued.)

The United States lake survey steamer General Williams is engaged in sweeping an area to the south of Colchester light in the west end of Lake Erie. A line of spar buoys carrying flags has been set out for survey purposes, about two miles south of the lighthouse and running parallel to the sailing course. Masters are requested to be on the lookout in this vicinity to avoid running over the buoys.

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A FEW THINGS THE COURSE FINDER WILL DO.

The mean correct magnetic course from Chicago to Pt. Betsey is N x E ¼ E. The correct magnetic bearing of the light on the SE end of Chicago breakwater in range with the light on the Chicago Waterworks crib is N ⅞ E. To make good this course place your boat on this range and when steady note the course by compass, and then port ⅜-point from whatever the course shown when on with this range will take you to Pt. Betsey.

Buffalo to Long Pt. same course as shown when in range with Buffalo Lighthouse and Waverly Shoal Gas Buoy. No matter what the course may be by compass when your boat is steady on the above range the course then shown by compass is the one you will have to steer in order to fetch Long Pt. correctly.

SE Shoal lightship to Cleveland, starboard ⅛-point from the course shown when in range with Chicago SE breakwater light and Four-Mile crib; or starboard ⅛ point from the course shown with Poverty Island Gas Buoy in range with Poverty Island lighthouse; or starboard ¼-point from the course that takes you from Old Mackinaw to Cheboygan lighthouse; or starboard ⅛-point from the course shown when heading on St. Mary's River Upper Range.

The foregoing information taken from the Course Finder is only an essence of what it contains. It contains just such information for every course on the Great Lakes. You can find it in a moment's notice. You can verify every course you steer by using this book. The work is not only correct theoretically but it works out the same in practice. No master can afford to be without a book of this nature. If it can do nothing else it should have the effect of relieving his mind of steering a wrong course in case he made a mistake. If it could do nothing else but verify his work, it is worth having. How many times does it happen in bad weather that the master becomes anxious about his course and is not sure of it. At such a time he would find the Course Finder invaluable to him. In addition to containing all the correct magnetic courses and bearings on the lakes, including harbors and the rivers, considerable space is given to the variation of the compass as it is found on the lakes and also much about bearings that have never heretofore been in print. The Course Finder will be found a valuable work for the young man who is trying to get to the front as a lake navigator. The book is based upon a method, that is of vital importance to lake navigation and a method that every lake navigator should be perfectly familiar with if he wishes to be truly a lake navigator. This method is fully explained in the Course Finder. If the Course Finder was of no other use in that it explained this method it would be worth all that is asked for it. The MARINE REVIEW can say conscientiously that there is no other book on the market today that is of so much importance and so practically useful as the Course Finder. The book is just from the press. The price is $2.50.

ARE MUCH INTERESTED.

A renewed interest is being taken by the men aboard ship in the questions for masters and mates now running in the MARINE REVIEW. More interest is being taken in these questions than ever and new contestants are entering the field. The contest is open to all and any one can enter at any time.

One contestant said that it was not so much the prize that he was after as it was the great amount of information he was getting in following and endeavoring to answer the questions. Another contestant writes that he has learned a great deal more from this question department than any one would believe. He says the questions suggest so many things that he would never have thought of if it were not for them. Many more are following the questions but have not entered the contest. They are doing this for their own information. The MARINE REVIEW does not care how it is done so long as the men for whom the questions are intended get the real good of them.

QUESTIONS FOR WHEELSMEN AND WATCHMEN.

THIRTEENTH INSTALLMENT.

143. What is a Modoc whistle and what is it used for?

144. What kind of a fog horn does a sailing vessel usually use?

145. What principle does it work upon?

146. What length must a boat be to carry only one anchor light?

147. What must her length be when it becomes necessary to display two such lights?

148. What is an anchor light?

149. What is the difference between an anchor light and a steamer's foremast light?

150. What is the difference between an anchor light and the range light of a steamer?

151. How would you sound an alarm signal?

152. What is a distress signal?

153. If you were heading SW over what points of the compass would your red light show?

154. Under the same conditions over what points of the compass would your head light show?

ANSWERS TO QUESTIONS FOR WHEELSMEN AND WATCHMEN.

TENTH INSTALLMENT. PUBLISHED JULY 25.

107. The one which has the other on her own starboard side must keep clear of the other. She would, as a usual thing port helm and go under the other's stern. This is in case of close quarters. If necessary she must stop and reverse, or to keep away by starboarding her helm. Consult Rule II.

108. The overtaking vessel or the one astern. Consult Rule VI.

109. Not less than 20 feet and not more than 40 feet.

110. At least 13 feet higher.

111. More than 75 feet.

112. Twelve compass points.

113. Yes.

114. From sunset to sunrise.

115. Sidelights, foremast light, after or range light, when underway alone. If towing another vessel she must in addition carry an additional foremast light and also a white light aft for the tow to steer by, such light not to be seen forward of abeam. With a raft in tow she would carry the two forward bright lights in a horizontal instead of in a vertical position.

116. Ring her bell rapidly for three to five seconds at intervals of not more than two minutes.

117. Getting farther away because the light is drawing astern.

118. A distinguishing light which burns for short intervals and then apparently goes out and then again flares up. It is used on board sailing vessels when a steamer is approaching them in the night time.

QUESTIONS FOR MASTERS AND MATES.—NO. 37.

Through an oversight the list of questions No. 37 for Masters and Mates was omitted when the list was resumed some weeks ago. The list should have been resumed with No. 37 instead of No. 38. Following is the questions for list No. 37:

532. What is a mean correct magnetic course?

533. What is the mean correct magnetic course between Detour and Middle Island?

534. What is the difference between a correct magnetic course and a mean correct magnetic course?

535. Is deviation an attraction of the compass needle or a disturbance of the needle?

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536. Explain what the difference is between an attraction of the compass needle and a disturbance of the needle.

537. If your steering compass read SE x S ½ S when on Lower Hay Lake Range, what course would you steer by it from Detour to Presque Isle?

538. If your standard compass read W ½ S with Vidal Shoal range over stern, what course would you shape by it from Devil's Island to Two Harbors?

539. What range in the Soo River would you use in shaping a straight course from Whitefish Pt. to Passage Island?

540. What range would you use in Chicago Harbor to shape a course to Pt. Betsey, and that you could depend on it?

COLLISION CASE SETTLED.

The Shenandoah collision case, which was started in July, 1901, and has been tried no less than five times, has been finally decided by the United States Supreme Court in favor of the government. James Davidson, the owner of the Shenandoah, has paid into the United States court at St. Paul, the amount sued for, $4,012, together with interest and costs amounting to nearly $1,000. This is a case where the steamer Shenandoah rammed the extension to the breakwater at Two Harbors while under construction. The cribs of the substructure had been sunk for the full distance and a temporary light was shown on the end of the last crib. The Shenandoah's pilot thought that this was the riding light of a vessel at anchor behind the breakwater and steered a course inside the temporary light that took him across the sunken cribs, which were dislodged and smashed by the impact of the vessel.

The government sued for damages and won four times out of the five that the case has been tried, the fifth time being a disagreement. One time the government was given a verdict for $1,000 which it refused to accept, and the last appeal to the Supreme Court of the United States has resulted as before noted.

The case has been bitterly fought on both sides, each litigant wishing the verdict to form a precedent for cases where temporary lights are in use during the progress of construction work.

WORKING ON THE NEW CHANNEL.

Work is in progress on the new all-American channel in the lower Detroit river. The channel has been divided into fourteen sections, and the dredges are at work on section 4, which is at the lower end of the channel, and extends into Lake Erie. The contractors on this section are G. H. Breymann & Bros., of Toledo. The big new dredge No. 9, owned by the C. H. Starke Dredge & Dock Co., which arrived at Detroit from Milwaukee last week, is also on the job. The new channel will pass west of Bois Blanc island and between Bois Blanc and Stony island. There is available for the work the sum of $2,000,000, and through the secretary of war the sum total of $4,670,000 has been authorized by congress to be spent on the improvement, which is of great importance to lake vessel interests. It will be two years or more before the new channel is completed. When it is placed in commission it will do away with congestion at the Lime Kiln crossing.

FREIGHTERS FOR 1908.

The Toledo Ship Building Co., Toledo, will build for H. S. Wilkinson and L. C. Smith, of Syracuse, N. Y., two steamers for 1908 delivery. The freighters will be 524 ft. over all, 504 ft. keel, 58 ft. beam and 30 ft. deep. Their engines will be quadruple-expansion with cylinders 20, 29, 42 and 61 in. diameters by 42 in. stroke supplied with steam from three boilers, 12 ft. 6 in. diameter and 12 ft. long, allowed 210 lbs. steam pressure. Both ships will be fitted with the Toledo Ship Building Co.'s patent ballast pumps and will be modern in every respect.

RUBBLE MOUND BREAKWATER.

The Great Lakes Dredge & Dock Co. was the only bidder for the construction of a rubble mound breakwater at Superior Harbor entry. The company bid $1.60 per ton for placing stone in position, the stones not to weigh less than ten tons each; or $1.25 a ton for delivering the stone on dock at Superior entry. Major Fitch, government engineer, has recommended the acceptance of the former bid. This is the second time that tenders for this work have been solicited, the first proposals calling for stones weighing twenty tons.

CYPRUS LAUNCHED.

The steamer Cyprus building for the Lackawanna Steamship Co. was launched from the Lorain yard of the American Ship Building Co. on Saturday last, and was christened by Miss Hazel Arnold, daughter of Alonzo Arnold, fleet engineer for Pickands, Mather & Co. The Cyprus is 440 ft. over all, 420 ft. keel, 52 ft. beam and 28 ft. deep, and is the fifth of the eight building to go into the water.

DEEPENING THE OHIO RIVER.

The meeting in Pittsburg last week of the review board of the corps of engineers, United States army, has again brought to the front the need of the nine-foot stage in the Ohio river which is so ardently desired by the business men of the seven states along its course. The completion of a nine-foot stage in the Ohio, by means of canalization, would be of untold benefit to the Ohio valley and the country at large and would greatly stimulate the industries of the section besides helping to solve one of the most momentous problems of the day, namely, transportation of commercial commodities.

AROUND THE GREAT LAKES.

The employees of the Great Lakes Towing Co. last week presented to Mr. A. Heath Carr, who was formerly assistant local manager, a beautiful watch charm.

The wrecking tug Howard and the schooner Grampian removed the machinery, boilers and equipment from the wreck of the steamer Panama on Lake Superior.

The steamer E. W. Oglebay ran on the rocks of Point Abino last week and was released after 500 tons of her cargo had been lightered under the direction of Louis F. Lautenschlager of the Hand & Johnson Tug Line.

The steamer Hiawatha of the Gilchrist fleet went ashore near Two Creeks, Lake Michigan, full of water. The steamer was bound from Escanaba to Indiana Harbor when she sprang a leak and was beached to save her from sinking in deep water. Capt. C. E. Benham left for the sea to take charge of the wrecking operations.

Dock & Construction Co. of Racine, Wis., was taken suddenly ill at Ashtabula last week while engaged in superintending the company's work under construction there. He was removed to the hospital where he underwent a serious operation.

The Iron King and Iron Queen owned by the Duluth & Atlantic Transportation Co. of Detroit have been sold to G. and H. D. Davidson of Buffalo.

The judiciary committee of the Milwaukee council has recommended the payment of claims arising out of the collision between the schooner Minnie Mueller and the Huron street bridge at Milwaukee. As the accident was due to the fact that the bridge tender was of such an advanced age that he could not see the schooner, Byron Kittleson was allowed $916.51 for damage to the schooner and Wm. E. Johnson $1,214.26 for personal injuries received in the accident.

Edward Gillen Sr., of the Gillen Dredge,

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GENERAL SITUATION AT HEAD OF THE LAKES

Duluth, Aug. 21.

The strike on the Mesabi range is a long way from being over and the present situation of labor scarcity in the underground mines gives every promise of continuing throughout the season though possibly in lessening degree. It is not a time for furnace men who receive their ore from underground properties to wonder why more ore is not being mined, for not an underground mine on the range has more than 80 per cent of the men it should have and certain mines have as few as a third of their former force now at work. The Steel Corporation is importing some men at Hibbing, Eveleth and Mountain Iron, but in all truth the quality of the labor and the conditions of importing it are not the most desirable.

The number of miners leaving the range is much decreased from that of the earlier days of the strike and now there are probably as many coming back as are going out, though at the end of last week 50 miners left Biwabik on one train. It is a strange circumstance that the miners seem to be shifting from one town to another, Nashwauk, for instance, having received last week nearly 25 men from Chisholm.

The open pit mines all over the range are getting out the scheduled amount of ore and are operating practically as before the strike except that they are well guarded by deputies. In the Hibbing district the underground mines of the Steel Corporation are working only day shift and with about two-thirds of the necessary miners. The Susquehanna mine has about one-third of its men, the properties of the Shenango Furnace Co. about three-fourths. At Mount Iron, the Iroquois mine is continuing to do better than last year. The Brunt is working with half of its men and, though threatened with trouble, the Mountain Iron pit is sending down a lot of ore. In fact the burden of the Duluth, Mesabi & Northern shipments come from the Hull-Rust, Morris and Mount Iron pits. The underground properties of the Republic Iron & Steel Co. are very short handed as are also the mines of Pickands, Mather & Co. The mines operated by Joseph Sellwood and up to last week operated with immunity were interfered with and a number of men left the Morrow and Cass. This is the time of year, of course, when there is always a scarcity of labor and the present shortage was undoubtedly enhanced by the fact that other employment was so readily available in the harvest fields.

The labor troubles on the docks are entirely settled, but the routine of shipments is far from being in good working order. The boats are still more or less bunched, a great deal of coal is being brought up and dispatch at the coal docks is not of the best. Owing to no fault of the dock men, some grades of bituminous coal are well stocked up on the docks and for the ore carriers the ore is not coming down in the best of shape. Figures are now available showing with considerable accuracy just what the strike has done to the shipments from the head of the lakes.

At the time of the beginning of strike the total shipment for the season from the three docks at the head of the lakes was 11,223,885 tons as against 9,219,198 tons in 1906, showing a gain up to that time of 2,004,687 tons. The total for the season up to the present time from the same ports is 14,309,787 tons as compared with 13,666,012 tons a year ago, so that the gain is now but 643,775 tons. Had the strike not intervened an additional gain of 900,000 tons at least would have been made in the month from the middle of July to the middle of August, so that instead of a gain of 643,775 tons at this time we should have a gain of practically 3,000,000 tons, which shows that the loss due to the strike has already amounted to about 2,300,000 tons.

	Week ending July 13.	Week ending Aug. 7.		Week ending Aug. 14.		Total to date.	
		1907.	1906.	1907.	1906.	1907.	1906.
Duluth	540,681	392,886	397,116	420,887	246,502	6,382,753	5,878,674
Two Harbors	360,009	168,308	251,476	306,466	313,719	4,078,618	4,577,194
Superior	228,723	300,279	202,297	298,444	218,648	3,848,416	3,210,144

SEASON COMPARISON.

Duluth, increase	504,079
Two Harbors, decrease	498,576
Superior, increase	638,272

The figures for the first two weeks of August are given below and also the shipments during the week ending July 13 to show the comparative rate at which the ore is being moved now and just before the strike.

From this it may be seen that Two Harbors was hardest hit because so many of its tributary mines are underground properties, and also it is shown that rather unexpectedly the Great Northern has lost the least.

The freighter Ward Ames, built at the yard of the Superior Shipbuilding Co. for the Acme Steamship Co. will be launched on Saturday, Aug. 24. She is a sister ship of the Wolvin and Wallace of the same line and is 552 ft. long and 56 ft. beam. The launching has been delayed and considerable work usually done after the boat is in the water has already been completed so that the steamer will soon be ready for sailing.

The energetic campaign carried on by the fuel companies at the head of the lakes intended to encourage inland retailers of the Northwest to buy their coal early when transportation facilities were available and thus avoid the famine of last fall seems to have borne some fruit. The following figures indicate the amount of coal shipped inland from the docks this year as compared with 1905 being the number of carloads moved during the summer quarter.

	1906.	1907.
May	8,646	17,838
June	10,110	15,109
July	9,793	15,497

These figures were compiled by the Lake Superior Car Service Association and show an increase over last year of 19,895 carloads, or on the basis of an average carload of 30 tons about 596,850. The most of this gain however is accounted for by the earlier shipment of railroad coal and coal for government and state uses. The farmers and small retailers while buying earlier than last year are still too backward.

The new coal dock of the Berwind-White Co. unloaded its first boat this week, the steamer Joe S. Morrow with 7,548 tons of coal. The entire time consumed was not available but a good record for new rigs was being made. The dock machinery was installed by the Dodge Cold Storage Co. and consists of three rigs and three bridges, the coal being transferred directly from the boat to the dock without going through any bins. The dock is situated on the Superior side of St. Louis bay next to the Pittsburg Coal Co.'s dock No. 3 and will be when completed 2,775 ft. long of which about 1,200 ft. will be completed this year. The dock is to have a storage capacity of 700,000 tons.

The telegraphers' strike has interfered greatly with the work of the vessel agents at this port. Passages at the Soo have not been obtainable with any regularity for about a week and yesterday a heavy storm in this locality broke down all the wires entering Duluth so that for the time being telegraphic communication is entirely cut off. The first notice of the location of up-bound boats during the last few days has frequently been their appearance off the pier here.

The movement of grain has again fallen to a normal movement for this time of the year or perhaps even less than that because of the unusually

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large shipments two weeks ago. The figures are as follows:

	Receipts.	Shipments.
Wheat	246,662	651,731
Corn	7,746	.....
Oats	11,719	63,911
Rye	3,428	28,187
Barley	21,126	7,626
Flax	89,759	245,981

The fluctuations in the freight rate on grain from the head of the lakes are given below with the dates on which they changed. As indicated the last change occurred August 7 and the market rate of that date still holds.

LAKE FREIGHT RATES FOR GRAIN—SEASON 1907.

FROM DULUTH TO ERIE-BUFFALO.

	Wheat.	Oats.	Rye.	Barley.	Flax
†April 22	2	1½	2	2	2
May 11	...	...	...	...	...
May 14	2¼	1¾	2¼	2	2¼
May 21	2	1½	2	2	2
May 23	1⅞	1⅜	1⅞	1⅞	1⅞
July 6	2¼	1¾	2¼	2¼	2¼
July 13	2	1½	2	2	2
*July 17	1½	1	1½	1½	1½
July 19	1	½	1	1	1
Aug. 7	1¼	¾	1¼	1¼	1¼

FROM DULUTH TO GEORGIAN BAY.

	Wheat.	Oats.	Rye.	Barley.	Flax
†April 22	2	1½	2	2	2
May 11	1¾	1¼	1¾	1¾	1¾
May 14	2	1½	2	2	2
May 21	...	...	...	...	...
May 23	...	...	...	...	...
July 6	...	...	...	...	...
July 13	...	...	...	...	...
*July 17	1½	1	1½	1½	1½
July 19	1	½	1	1	1
Aug. 7	1¼	¾	1¼	1¼	1¼

FROM DULUTH TO KINGSTON.

	Wheat.	Oats.	Rye.	Barley.	Flax
†April 22	4¼	3¼	4¼	3¾	4¼
May 11	4⅛	3⅛	4⅛	3⅝	4⅛
May 14	...	...	...	...	...
May 21	...	...	...	...	...
May 23	...	...	...	...	...
July 6	...	...	...	...	...
July 13	...	...	...	...	...
*July 17	...	...	...	...	...
July 19	...	...	...	...	...
Aug. 7	3¾	2¾	3¾	3¼	3¾

FROM DULUTH TO MONTREAL.

	Wheat.	Oats.	Rye.	Barley.	Flax
†April 22	6	4½	6	5½	6
May 11	...	...	...	...	...
May 14	...	...	...	...	...
May 21	...	...	...	...	...
May 23	...	...	...	...	...
July 6	...	...	...	...	...
July 13	...	...	...	...	...
*July 17	...	...	...	...	...
July 19	...	...	...	...	...
Aug. 7	5⅝	4⅛	5⅝	5⅛	5⅝

†Opening of navigation.
*Caused by ore strike.

VESSEL OWNERS AND WIRELESS TELEGRAPHY.

A meeting of vessel owners was held in Cleveland, Thursday, to discuss plans for the extension of the wireless telegraph system throughout the great lakes. The Clark Wireless System is the only one that has made headway on the great lakes and has now stations established at Cleveland, Port Huron, Detroit and Buffalo. By fall another station will be established at Sault Ste. Marie, but vessel owners are generally desirous of having stations at all the important turning points on the lakes, owing to the superiority of this method of communication over all others. Plans were discussed of assisting the Clark system financially.

NAVAL FIGHTING STRENGTH OF NATIONS.

BUILT.

	Great Britain.	France.	Russia.	Germany.	Italy.	United States.	Japan.
Battleships, 1st class	55	19	8	18	14	14	9
" 2nd "	4	9	3	4	—	1	2
" 3rd "	2	1	1	9	2	—	—
Coast Defence Vessels, Armored	—	9	6	11	—	11	3
Cruisers, Armored	28	19	3	6	6	7	9
" Protected, 1st class	21	7	6	—	—	3	2
" " 2nd "	46	14	2*	14	5	17	11
" " 3rd "	19	16	1	12	13	2	7
" Unprotected	—	1	3††	15‡‡	1	6	7
Scouts	8	—	—	—	—	—	—
Torpedo Vessels	21	15†	7	1	11	2	3
Torpedo Boat Destroyers	143	31	68	43	13	20	29
Torpedo Boats	87	255	172	84	128	32	79
Submarines	25	39	13	1‡	2	8	5

BUILDING.

Battleships, 1st class	6	6 6§	4	6 2§	4	11 2§	4 2§
Cruisers, Armored	10	5	4	2 1§	2	8	3 2§
" Protected, 1st class	—	—	1	—	—	—	—
" " 2nd "	—	—	—	6 2§	—	—	1
Scouts	—	—	—	—	—	3	—
Torpedo Boat Destroyers	18	23 10§	29	6 12§	4	—	25
Torpedo Boats	—	52	—	—	20	—	—
Submarines	15	30 20§	15	1‡	4	4	2

* Including one Partially Protected. † Including one Torpedo Depot Ship.
‡ Experimental. || Including two Partially Protected. †† Including two used as training ships
‡‡ Including six used as training ships. § To be laid down 1906-1907.

INSTRUCTION OF MIDSHIPMEN.

With the arrival at Annapolis of Lieut.-Comdr. William H. G. Bullard, recently on duty on the battleship Maine, and who has been assigned to preside over the new department of electrical engineering, active work on the establishment of this course of instruction for midshipmen was begun. The department will be opened at the beginning of the next academic year, on October 1. The establishment of this department of electrical engineering is in accordance with the recommendations made by the Wainwright board, which conducted an investigation of the course of studies pursued at the naval academy with a view toward revising it. The new department has been made out of the department of physics and chemistry, of which Prof. Nathaniel M. Terry has been the head since 1886.

MISCELLANEOUS ITEMS.

The steamer Winnipeg broke her wheel in Niagara river on Monday and will be repaired at Buffalo.

The new steamer J. C. Morse will leave the Cleveland yard of the American Ship Building Co. on her maiden trip on Saturday next.

The five masted schooner, Elvira Ball, will be launched at the yard of the Gilchrist Transportation Co., Mystic, Conn., on Saturday, Aug. 24.

The steamer Henry Oliver of the Wilson Transit Co.'s fleet and the steamer Ericsson with the barge Manila of the Pittsburg Steamship Co.'s fleet were in collision in the straight cut at Grosse Point just above Belle Isle. The Manila's bow was badly damaged in the mixup but she went on to Conneaut.

A revised chart in colors of Agate and Burlington bays, Lake Superior, has just been issued by the United States lake survey and is now for sale by the MARINE REVIEW.

Contract for the improvement of the Erie canal between deep water at Oneida lake and Mosquito Point bridge over the Seneca river, known as Contract No. 12, has been let to the Stewart-Kerbaugh-Shanley Co. of 527 Fifth ave., New York, upon its bid of $3,391,716.

The steamer Winnipeg has been libeled by United States Attorney Bass to recover damages for injury done to the light and fog signal station in the harbor at Cleveland. The libel states that on May 26, the Winnipeg in command of Capt. C. T. Clark with three barges in tow was leaving Cleveland harbor when one of the barges, the St. Louis, struck the light station demolishing piles and lumber and doing damage to the amount of $496.00.

The United States lake survey is notified by Col. Chas. E. L. B. Davis, the United States engineer officer in charge of the improvement, that the channel through Round Island Shoal No. 1 at head of St. Mary's river has been widened to 1,000 ft. (formerly 800 ft.), with depth of 23 ft. Black Can Buoy No. 9 and Black Spar No. 7 have been moved 200 ft. southerly to mark the south bank of the channel as improved. Round Island Shoal No. 2 has been widened to 975 ft. (formerly 800 ft.), with 23 ft. depth, and Gas Buoy No. 5 moved 175 ft. to the south so as to mark the added width.

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ELECTRICAL DOCK PUMPING.

W. C. Mountain read a paper on "The Application of Electricity to the Driving of Pumping Machinery for Pontoon and Graving Docks" at a meeting of the North-East Coast Institution of Engineers and Ship Builders. Electricity was now being used, he said, to such a large extent in all modern ship yards and engineering works, and could be produced at such a moderate price (either by the consumer's own plant, or purchased from an outside supply company), that it became the duty of all those connected with the manufacturing industries of the country to look into further applications. The writer thought that the driving of the electric pumping machinery in graving and pontoon docks was a use to which electricity could be applied with the greatest advantage. He would not recommend putting down an electrical generating plant for driving the pumping machinery of a single or probably even two docks, but where dock owners possessed a number of docks there was no doubt that one central station which could supply current to the whole of them would be found very much more economical than independent steam pumping stations with a staff of men at each dock. The same remarks applied to the driving of the pumping machinery on pontoon docks. These, of course, were specially suitable for electric driving, as it was either necessary to have steam machinery in a very cramped position, or to convey steam from the shore through flexible pipes. Electricity could, of course, be much more conveniently conveyed by simple cables. The whole question, however, was one of cost. To facilitate elucidation of the point, Mr. Mountain gave details of a large number of docks. For the whole of these details we have not space, of course, but three sets of figures may suffice. The first set refers to Smith's West Pontoon, North Shields, which is electrically driven:

Capacity of docks in tons	6,400
Size of dock: Length in feet	435
Width in feet	66
Draught in feet on sill when pontoon is sunk	21¼
Tons of water to empty	8,500
Head in feet, maximum	22
Type of pumps	Vertical centrifugal
Number of pumps	8
Diameter of discharge pipe in inches	18
Capacity in gallons per minute	7,930
Number of motors	8
Horsepower of each	60
Cost of upkeep	Very slight
Source of supply—Own plant—two 200 K. W. D. C. dynamos	
Voltage	460
Consumption in B. T. U.'s to empty.	276
Price of current per unit	1d.
Cost per lift	23s
Time to empty in minutes	40
Number of men attending motors	2
Wages per man per week	36s.
Number of vessels docked per year	144
Gross tonnage docked per year	502,533
Approximate value of pumping plant	£3,798
Cost per ton docked: Power	.079d
Interest and depreciation at 10 per cent per annum	.182d
Wages	.089d
	.350d

It would be noted, Mr. Mountain said, that the whole of the electrical pumps on the pontoon were attended to by two men and that the cost of pumping per ton docked was only .350d. The eight electrical motors were of the vertical spindle type, each motor being capable of developing 60 e. h. p. when running at a speed of 385 r. p. m., with 460 volts at the terminals. These motors had run for about six and a half years with very little cost of upkeep. The weight of the armature was supported by means of a ball bearing, which was carried by the bedplate of the motor, and the upper end of the spindle ran in a bush. In later types the makers had adopted ball bearings at the top and bottom. At the bottom of the vertical shaft of the motor there was a flexible coupling consisting of a cast-iron plate with four steel driving pins, which drove into the lower half of the coupling secured to the top of the vertical pump shaft between the motor and pump. The weight of the vertical shaft was also carried by a cast-iron deck plate containing a ball bearing, so that all weight was taken off the spindle of the centrifugal pump. The intermediate bearings were fitted with gun-metal brasses and with oil pipes leading down from the back, so that each bearing could be lubricated. The pumps were of the vertical spindle type with the delivery branches placed horizontally, the water being brought in through a single inlet at the bottom of the pump to a single-sided impellor. The valves for controlling the pump were worked from a deck house, and the switching and starting gear in connection with the motors were also worked from the upper platform. The Smith Co.'s East Pontoon is steam driven, and for the purpose of comparison Mr. Mountain gave the following figures regarding it:

Power used for pumping	Steam
Capacity of dock in tons	3,200
Size of dock: Length in feet	335
Width in feet	50
Draught in feet on sill when pontoon is sunk	20½
Tons of water to empty	5,170
Maximum head in feet	20
Type of pump	Horizontal centrifugal
Number of pumps	4
Diameter of discharge pipe in inches	22
Capacity in gallons per minute	7,240
Number of boilers ashore	2
Time to empty in minutes	30
Men required for attending to pumps and proportion for stoking	4
Total wages per week, say	108s.
Number of vessels docked per year	96
Gross tonnage docket per year	239,719
Approximate value of pumping plant estimated	£2,000
Cost per ton docked: Power	.222d
Interest and depreciation at 10 per cent per annum	.201d
Wages	.282d
	.705d

Electricity could, Mr. Mountain went on to say, be as economically applied to the driving of Graving Dock Pumps, and he gave particulars of the installation at Blyth of the Blyth Ship Building Co. This dock was originally driven by two steam engines driving the main pumps, and two small engines driving the drainage pumps, and the problem which had to be faced was to supply motors which could fit on to the foundations of the steam engines and enable the change over to be made in the shortest possible time. Mr. Mountain therefore designed two special multipolar motors which were built to fit into the space between the two existing centrifugal pumps. Each motor was entirely self-contained, that was, the shafts ran in their own bearings, so that either motor could work independently of the other, each motor normally being of 105 e. h. p. when running at a speed of 250 r. p. m.

	Dock No. 1	Dock No. 2
Power used for pumping	Electric	Electric
Size of dock: Length in feet	377	320
Width in feet	55	55
Tons of water to empty	12,000	7,000
Maximum head in feet	30	30
Pumps: Type	Horizontal centrifugal	
Number of pumps	2	
Diameter of impellers in inches	48	
Diameter of discharge pipe in inches	20	
Gallons per minute, each	8,400	
Number of motors	2	
Horsepower of each	105	
Cost of upkeep	Very slight	
Current: Source	Town supply	
Voltage (direct current)	460	
Consumption in B. T. U.'s to empty	460	
Price per unit	460	312
Cost per lift	1¼d. less 5 per cent	
Time to empty in minutes	45s. 7d.	35s. 2d.
Men: Number	120	120
Salary	1	
Number of vessels docked per year	28s.	
Gross tonnage docked per year	75	
Approximate value of pumping plant	183,000	124,000
	£1,700	
Cost per ton docked		
Power	.224d.	.255d.
Interest and depreciation at 10 per cent	.133d.	
Wages	.056d.	
Total cost per ton docked	.413d.	.444d.

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The motors in conenction with the drainage pumps were of 40 H. P. and 13 H. P. respectively. The actual change over from steam to electricity was carried out over a week-end, so that the Blyth Ship Building Co.'s docking arrangements were in no way interfered with.

This installation had been running for several years without a hitch of any kind, and was a practical example of how an existing dock, with its steam machinery, could be converted into an electrically-driven dock at a very small expense, and with very satisfactory results from a working standpoint. From figures supplied by the Blyth Ship Building Co. it appeared that under the old steam pumping the cost for coal, stores, wages and water for boilers, for emptying the dock about twenty times, was £169 9s. 7d. With the electrical plant, for emptying the dock nineteen times, the cost was £99 9s. This showed a very considerable saving.

By the courtesy of Messrs. Robert Stephenson & Co. Mr. Mountain was able to give some particulars of the firm's steam-driven dock at Hebburn.

Power used for pumping	Steam.
Size of dock: Length in feet	700
Width in feet	90
Draught in feet on sill at ordinary spring tides	29
Tons of water to empty at this draught	63,200
Tons of water to empty at 26 ft. draught	56,000
Maximum head	39 ft. 8 in.
Average head	20 ft. 0 in.
Pumps: Type	Tangye, horizontal, centrifugal
Number	2
Diameter of impellers in inches	72
Diameter of delivery branch in inches	45
Capacity in gallons per minute	80,000
Engines: Number	2
Type	Vertical compound direct coupled
Diameter of cylinders in inches	13½ and 27
Length of stroke in inches	20
Indicated horsepower of each	350
Men: Number	2
Wages per week per man	36s.
Total wages per week	72s.
Number of vessels docked per year	60
Gross tonnage docked per year	189,896
Approximate value of pumping plant	£7,000
Cost per ton docked: Power	.099d.
Interest and depreciation at 10 per cent per annum	.885d.
Interest and depreciation at 10 Wages	.114d.
	1.098d.

The cost per ton docked was in this case higher than at any of the electrically-driven docks with the exception of Aberdeen. This was probably due, Mr. Mountain thought, to the fact that the total tonnage docked was small.

MISCELLANEOUS PARAGRAPHS.

Lt. Col. W. L. Marshall, government engineer, New York, will open bids on Aug. 26 for building an embankment at Governor's island, New York harbor. The sum of $300,000 is available for the work.

A dispatch from Kiel is that the new turbine-driven torpedo boat 137 obtained a speed of 39.9 knots an hour under forced draft. If this is true she is the fastest warship in the world.

The Viper, one of the four submarines constructed for the United States navy by the Fore River Ship Building Co., Quincy, Mass., has completed its torpedo trials in Narragansett Bay. She was submerged forty feet and while running at full speed, loaded, fired four torpedoes, three of them hitting the target.

Major J. C. Sanford, corps of engineers, Philadelphia, Pa., opened bids recently for the construction of a single screw suction dredge for the Columbia river, Oregon. The bidders were the Moran Co., Seattle, Wash., at $285,000, the Newport News Ship Building & Dry Dock Co., Newport News, Va., at $234,500, and the Maryland Steel Co., Sparrow Point, Md., $239,850. Contract was awarded to the Newport News Co.

The government of Belgium is carrying out its plans to make Antwerp the largest harbor in Europe and render it capable of carrying on an immense trade. With this end in view, a total of $28,200,000 has been set aside, and the last installment of this sum, $9,600,000, was voted upon in the chamber of deputies very recently. Ample fortifications are included in the plans as well as sufficient docks.

Capt. Daniel Friele, commodore of the fleet of the Pacific Mail Steamboat Co., San Francisco, Cal., has been appointed master of the company's liner Manchuria, which sailed for the Orient August 8 for the first time since her mishap on the reefs of the Hawaiian Islands. The Manchuria has been thoroughly repaired and is in every way as good as new. Capt. Friele has been with the company for more than twenty years.

The articles recently published in the newspapers that the steamer City of Chicago of the Graham & Morton line had had an accident was an error. The steamer was the City of Benton Harbor. Her damage consisted of the breaking of one wheel arm, delaying her in the lake about an hour and a half. After the broken part had been disconnected she came in under her own steam and has been running regularly ever since.

The contractors for supplies and the workmen who are deriving an existence from catering to the wants of the battleship squadron are opposing the plan to send the fleet to the Pacific. It is believed that 15,000 men will be thrown out of employment if the ships are sent westward and congressmen of the Atlantic states are being urged to make a patriotic movement against war scares, to induce the administration to allow the fleet to remain on the Atlantic side.

The San Francisco & Portland Steamship Co., Portland, Ore., has purchased the steamer Kansas City from the Ocean Steamship Co., of Savannah, Ga., to replace the ill-fated Columbia. The Kansas City will run in conjunction with the steamer Lawton, which was recently purchased from the government and remodeled. The Kansas City is of 2,164 tons net register, 327 ft. long, 45 ft. beam and 18.08 ft. deep. She has a capacity for 500 passengers and 3,000 tons of freight. The Kansas City has been engaged in the service between New York and Savannah. She will leave at once for the Pacific and is expected to arrive there early in October.

Orders were issued Aug. 12 by the navy department detaching Rear-Admiral Stockton from command of the special service squadron and assigning him to duty as president of the naval examining board at Washington. Rear-Admiral Sebree, recently detached from duty on the lighthouse board, will succeed Rear-Admiral Stockton in command of the squadron, which consists of the Tennessee and Washington, recently returned from the International Maritime Exposition at Bordeaux, France. These vessels will be united with the cruisers South Dakota and California, now at San Francisco, to form one of the armored cruiser squadrons of the Pacific fleet.

Major Harry F. Hodges, of the United States army recently entered upon his duties as purchasing agent of the Isthmian canal commission, with headquarters in Washington. Major Hodges succeeds David W. Ross, who has been in that position about two years. The plan of Secretary Taft for a reorganization of the administrative methods of the canal commission becomes effective through an order from President Roosevelt at the time of the change of officials. In accordance with this plan much of the work which has heretofore been done in Washington will be done on the isthmus where the office of the secretary of the commission will be located. Mr. Ross is to become managing director of the Magnus Metal Co., New York, which concern is also affiliated with the Witt Mfg. Co., Chicago.

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WEST NEEBISH CHANNEL OF THE ST. MARY'S RIVER

(From the *Engineering Record.*)

The improvement of the West Neebish channel of the St. Mary's River, which connects Lake Superior and Lake Huron, was undertaken several years ago by the United States government and has approached a stage of completion indicating that under normal conditions this extensive work will be finished before navigation closes this fall, or at latest by the opening of navigation next spring. One of the most serious handicaps to the great volume of traffic passing through this river between Lake Superior and the other Great Lakes will then be relieved. Originally up-bound vessels plying the St. Mary's River were obliged, after leaving the head of Mud Lake, which is some twenty miles, in a direct line from Lake Superior, to pass to the east of Neebish Island and thence follow a long circuitous route round Sugar Island through Lake George and Little Lake George to reach the locks at the Sault Ste. Marie Rapids in the River. The channel along the east side of Neebish Island was improved several years ago to provide a minimum depth of 21 ft. at the mean stage of water in the river. About the same time a channel with a minimum depth of 21 ft. was excavated between the upper end of Neebish Island and the lower end of Sugar Island; this channel was continued on up the river to deep water in Hay Lake, about 10 miles below the locks at Sault Ste. Marie. The new channel thus formed, generally called the Middle Neebish, greatly shortened the sailing distance between Neebish Island and the locks and is used by traffic practically to the exclusion of the old channel, the great fleet of large ore and grain-carrying vessels which pass through the river being included in this traffic.

At the same time the hazards presented to traffic by the Middle Neebish Channel became a serious menace to that traffic long before the latter reached its present tonnage, which during the average open navigation season of 243 days is greater than that of any other inland waterway in the world, having reached a total of over 51,500,000 tons in 1906. Several sharp turns in the Middle Neebish channel, the greater part of which is artificial, are the most dangerous features offered to the safe passage of vessels through it. In the first place the approach to them from one direction cannot be seen from the approach from the opposite direction, owing to the height of the wooded intervening land. On the other hand, the five to six-mile current in the river at this point requires the downbound vessels to maintain a speed of eight to twelve miles an hour in order to obtain steerageway. Since the larger loaded ore and grain vessels, many of which are over 550 ft. in length and draw in the neighborhood of 19 ft. of water, from the principal portion of the downbound traffic it is evident that they cannot be controlled readily at the turns in the channel. Furthermore, the upbound traffic consists mostly of the same large vessels, which generally return to Lake Superior loaded with coal.

The menace offered by these turns and the conditions surrounding them has thus greatly hindered traffic at all times, and has resulted in numerous serious collisions. The extreme care that is observed in navigating this channel, frequently necessitating a vessel to lie at the mouth of the St. Mary's river during the night in order to make the channel by daylight, has, however, reduced the number of accidents to a minimum. To avoid these delays, the schedules of vessels are arranged, when possible, so the channel will be reached during the day. A large number of vessels, nevertheless, make a night passage through the St. Mary's river, rather than wait for daylight.

The West Neebish channel is being excavated to relieve the present situation. It will provide a shorter and straighter course than the Middle Neebish channel, with fewer turns, all of which can be navigated safely, and will have a minimum depth of 22 ft. below extreme low water. It connects the lower end of Hay Lake with the upper end of Mud Lake, passing between the west side of Neebish Island and the mainland, and has a total length of aproximately 13.5 miles. The upper and lower reaches of this channel extending, respectively from Hay lake to the West Neebish rapids of the St. Mary's river and from those rapids to Mud lake were excavated in sand, clay and mud and are finished. The remaining section of the channel, extending through the rapids, with a total length of about 2.5 miles, forms the most difficult part of the whole project, as it has to be excavated almost entirely in solid rock. This section is now rapidly approaching completion, however, the expectation being that, with reasonable success, it will be done before Dec. 1. After the opening of the new channel on the west side of Neebish Island, the Middle Neebish channel will be deepened to the same depth of 22 ft. at extreme low water. Downbound traffic will be diverted through the West Neebish channel after the improvements are finished and upbound traffic will continue to use the Middle Neebish channel, making a double sailing course in the most difficult part of St. Mary's river, and a practically double course from Lake Superior to Lake Huron.

The new channel has a minimum width of 300 ft., and a clear swept depth of 22 ft. at the lowest stage of the water in the river. The upper reach, extending from Hay Lake to the rock section through the rapids, has a total length of approximately six miles, with only one slight turn. The water along the site of this part of the channel varied from 3 to 5 ft. in depth before excavation was started; the excavation was made through mud and sand with large dipper dredges, the excavated materials being loaded on scows, in which they were hauled to shallow water along the shore line and dumped. The lower reach of the new channel in a distance of some two miles between the downstream end of the rock section and the original river channel had 22 ft. or more water, so no work was required in this length. From the lower end of this natural deep channel to Mud lake a new channel, approximately three miles long, was dug through the sand, clay and mud which formed the bed of the river. This three-mile section has only one turn, and its channel is widened at this turn to permit easy navigation, as is done at all turns in artificial channels. This section of the channel was also made with dipper dredges from which the material was carried on scows to dumping grounds. The water in the West Neebish rapids of the St. Mary's river through which the rock section had to be built, varied from a few inches to several feet in depth and had a current with a velocity of 4 to 7 miles an hour. The bed of the river was a solid ledge of hard Niagara limestone for 8,600 ft. of the 13,300-ft. section included in the contract for this work. This limestone ledge was covered with scattered boulders, varying from small stones to those containing 2 cu. yd. or more. The specifications under which the contract for this work was awarded required that cofferdams should be constructed which would unwater these rapids over a length of about 6,000 ft. of the channel; and that the remainder of the work could be done by dredges. These conditions were changed, however, to permit the construction of cofferdams which would unwater a length of 8,800 ft. of the river through the rapids, the remainder of the work to be done by dredging.

The contract for the construction of

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the 2.5-mile section of the channel through the West Neebish rapids was awarded to MacArthur Bros. Co., of Chicago, on April 7, 1904. This company built the large cofferdams required to unwater the portion of the excavation to be done in the dry, and then sub-let that portion of the work, involving approximately 1,700,000 cu. yd. of rock excavation to Messrs. Grant, Smith & Co., of Chicago, of which company Mr. C. H. Locher, associate partner, is manager in charge of the work, and Mr. G. P. Locher is superintendent. The contract for the portion of the excavation to be done outside of the cofferdam with dredges was let to Edward Bros., of Sault Ste. Marie.

Construction Plant and Methods.—The first work of the construction was to build two temporary cofferdams about midway between the two main cofferdams. These temporary dams were about 1,000 ft. apart at the site of the channel and extended across the river from the mainland to the island, varying in direction to suit the contours of the river bed. They were built in 2 to 7 ft. of water flowing 3 to 6 miles an hour. The construction of these dams stopped the flow of water in the West Neebish channel of the river, so the main cofferdams could be built in still water, and also laid bare a part of the site of the channel about 1,000 ft. long. In building these temporary dams, which varied from 4 to 10 ft. in height, broken stone and rock were dumped from scows on the line of the dams until the force of the current was broken and the rock-fill carried above the water. Sandy clay was then brought in and dumped on the upstream side of these rock embankments in order to silt up the openings in the latter and produce water tight dams. The dams were completed in July, 1904, after which the water was immediately pumped out of the area enclosed between them and work started on the rock excavation. Two of the four cableways which have been employed in the construction of the rock section of the channel had been installed meanwhile and were placed in service to hoist the excavated material out of the cut and convey it to spoil banks along the channel.

Main Cofferdams.—The two main cofferdams which unwater the 8,600-ft. section of the work that is being excavated in the dry, are structures of unusual magnitude. The upstream dam is L-shaped, and is built in water from 2 to 18 ft. deep; the stem of the ell extends from the mainland across the river at right angles to the channel for 1,200 ft., the leg of the ell continuing downstream 700 ft. from the outer end of the stem to the shore of the island, making the total length of the dam 1,900 ft. This cofferdam has a minimum width of 8 ft. at its top, which is 7 ft. above the water, and has side slopes on the water side of about 1 on 1½ and of about 1 on 2 on the other side. The other main cofferdam is 8,600 ft. downstream from this one. It has a total length of 2,600 ft., and in plan is arched slightly downstream against the water on that side of it. This cofferdam was built in water from nothing to 26 ft. deep; it has a minimum width of 12 ft. at the top, which is 6 ft. above the water; its side on the water side is built on an average slope of 1 on 2, and on the other side of 1 on 2½.

The construction of the upstream main cofferdam was started soon after the current of the river had been broken by the temporary dams. Sandy clay and mud excavated by the dredges at work on the adjacent sections of the channel were brought to the site in bottom-dump scows and deposited in place. When the banks thus formed had been carried up until the bottom-dump scows would operate no longer, the materials were loaded on flat deck scows, and handled from these to place in the embankment by a clam-shell bucket on a derrick scow. The final trimming and finishing of the portion of the dam above the water was done with wheelbarrows and by hand. This dam was finished November 1, 1904, after which the water covering the area between it and the upstream temporary dam was pumped out.

The downstream main cofferdam was also built from scows up to within 5 to 6 ft. of the water surface, with materials excavated by the dredges. Soon after this part of the work was finished in the fall of 1904 the river froze over, and the cofferdam was completed through the ice. The rock that had been taken from the portion of the channel on which work was already in progress was hauled on sleds on the ice to a point over the part of the dam already built. This haul was from 4,000 to 4,500 ft., and as much as three cords of stone were carried on a sled at a load. A channel was cut through the ice over the dams in order that the stone could be dumped on top of the bank already built. This dumping was done in such manner as to form a small bank along each side of the top of this base. When these two parallel banks had been carried up to the water surface in this manner, the space between them was filled with sandy clay which contained a considerable quantity of gravel and small boulders, taken from a borrow pit on the mainland. After the space between the two small banks of rock on each side of the top of the lower section of the dam had been filled with the material from the borrow pit the same material was used to top out the dam to its full height of 6 ft. above the water level. The material was hauled from the borrow pit to the dam in boxes on sleds and dumped into place through the ice. After the dam was about finished, a narrow-gage light railway was laid the full length of it and extended to the borrow pit in order to have it available in an emergency. This dam was completed in April, 1905, and the last part of the area between the two main cofferdams was unwatered soon after.

Only one accident of any moment occured to either of the two main cofferdams after they were built. In Feb. 1905, the upper part of a 200-ft. length of the leg of the upstream dam, near the shore where the dam section was light became detached from the remainder of that dam and was carried over into the area which had been unwatered, with the result that that area was flooded. The cause of this accident has never been certainly determined. It is believed, however, to have been brought about by the formation of a line of cleavage in the dam by freezing, followed by a change in the river level which lifted the detached portion and floated it away. This break was soon repaired and since then an open channel maintained in the ice on the water outside the dam has avoided further similar difficulty. This channel was kept open by simply piling brush on it and covering this brush with loose snow; the top and slopes of the dams were also covered with brush to collect snow which prevents freezing and the formation of cleavage planes. Although temperatures of 20° below zero, Fahr., are common in the locality where the work is in progress, this simple expedient forms a line of separation between the main body of the ice and that attached to the slopes of the dam.

Pumping Plants.—The quantity of water which leaks through the cofferdams is very slight when compared with the great length and height of these dams. At the same time, a large amount of pumping capacity was required to remove the water which covered the area enclosed by the dams. The total capacity of the pumps installed is about 40,000,000 gal. per 24 hours. This capacity is required only a small portion of the year, however, but is all necessary in the spring when the snow is melting, or during excessive rains. A berm ditch on each side of the river, extending the full length of the work on the island side and two-thirds the length on the mainland side, diverts the drainage from the land into the river and prevents it reaching the area between the cofferdams. A 12-in. centrifugal pump on the upstream cofferdam handles the principal part of the

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water in that end of the area enclosed. Two 6-in. reciprocating pumps in this end of the channel cut are capable of removing the water from the latter. Two centrifugal pumps, one a 12-in. and the other a double section 18-in. are installed in a pump house on the downstream main cofferdam to pump the water from that end of the work. Two reciprocating pumps, an 8-in. and a 12-in., are placed in a house on the edge of the channel cut, about midway between the main cofferdams, and pump from the cut into a flume leading to one of the berm ditches. A 12-in. centrifugal pump in a house on the opposite side of the channel near this point is also used while the snow is melting and during heavy rains. The water in the downstream end of the channel cut is removed by three 8-in. reciprocating pumps.

General Features of Construction Plant.—The controlling feature of the extensive construction plant which has been installed by Messrs. Grant, Smith & Co., is the adaptability and arrangement of the various parts of this plant to be operated day and night, six days a week, throughout the year. The long and extremely cold winters of the locality in which the work is being carried on required unusually careful precautions in the choice of the equipment to be installed. At the same time, the continued low temperature of the long winters, the large amount of snowfall which occurs and the great quantity of ice that forms in a work of this character interfered seriously with the progress of the construction. In fact, it is believed that the cost of handling work during the winter months has been 25 per cent greater than it is during the remainder of the year.

An idea of the climatic conditions in this locality may be obtained from the records of the station of the United States Weather Bureau at Sault Ste. Marie. The mean average temperature throughout the year for a long series of years, as given by those records was 39° Fahr. During four months of the year, Dec., Jan., Feb. and March, the average monthly temperature for the same series of years was considerably below 32° Fahr., with frequent temperatures as low as 25° below zero, Fahr. Ice forms on open water six months in the average year, reaching a thickness of 30 in., or more during the winter. Added to these conditions some snow falls nearly every day in the winter and the annual snowfall is quite heavy, the ground generally being covered with from two or three ft. of snow during the winter. Notwithstanding these extreme climatic conditions the construction work has been handled day and night, practically without interruption, except for Sundays, since its inception. During 1906 the government engineers credited the contractor with 290 working days and nights, without including seven holidays on which work was in progress. This record does not mean, either, that part of a day was counted as a full one, because all of the men are provided with rubber clothing, so work is rarely stopped by rain or snow, the rock bottom of the cut always providing a good working foundation.

The various equipment and plant connected with the work is operated, with a few exceptions, on air furnished from a central compressor plant. Air-driven rock drills are employed in making the large number of blast holes in which the channel cut is excavated. The loosened rock is loaded into large skips by steam shovels, the skips being hoisted out of the cut, conveyed to spoil banks along the side of the channel and dumped in these banks by long-span cableways with traveling head and tail towers. All of this equipment was selected largely on account of its adaptability to work continuously under the trying climatic conditions, which become particularly strenuous at night during the winter.

Compressor Plant.—The equipment in the central compressor plant is as complete as that in most permanent plants of this kind, and was installed with as great care. The plant may, in fact, be considered a permanent one, since it has been operated continuously for over three years. It is in a tight frame building, 40 x 108 ft. in plan, which is divided by a transverse partition wall into a boiler room and an engine room. The boiler room contains three 200 H. P. Erie City sectional water-tube boilers placed in brick settings on concrete footings. These boilers are operated at 150 lbs. pressure and are each served by an 80-ft. stack. They are supplied with feed-water by either of two Snow boiler-feed pumps, which draw from a Kelly-Berryman feed-water heater. This heater operates on exhaust steam from the auxiliary units in the plant.

The engine room contains two cross-compound two-stage Rand compressors; one of these has 40 and 23-in. air cylinders and a 48-in. stroke, producing a capacity of 4,527 cu. ft. of free air a minute at 90 lbs. pressure; the other machine has 17 and 30-in. air cylinders and a 30-in. stroke and produces 1,900 cu. ft. of free air a minute at 90 lbs. pressure. The largest compressor is driven by a cross-compound 700 H. P. Newburg Corliss engine, and the smaller one by a cross-compound 325 H. P. Hamilton Corliss engine. These engines are operated condensing, each of them being equipped with a Dean jet condenser. Circulating water for the condensers is supplied by any one of three pumps in the basement of the engine room. These pumps also supply water to the feed-water heater from the condenser hot well, or from the river.

All of the various units in the plant are on heavy concrete foundations, which were built with special care. The bed plates of the two main units are placed directly on the concrete, without any cap stones. No trouble from vibration of the engines or compressors has ever been experienced, however, although both compressors are in service 23 hours a day for at least six days a week.

The compressors deliver to an air receiver, 4 ft. in diameter and 18 ft. long, just outside the building, from which air is piped to various parts of the work. An 8-in. pipe line, 6,000 ft. in length, extends along the mainland bank of the river, and is continued an additional 2,000 ft. as a 6-in. line. This 8,000-ft. line is provided with several L-shaped vertical joints to provide for expansion and contraction. The line is also laid to drain to drip cocks placed at convenient intervals, in order that the condensation may be removed readily. A second receiver of the same size as the first is placed on the 8-in. line 3,650 ft. from the compressor plant, to provide for sudden demands for air. Taps are made in the main line so branches can be carried to the various plants at any point along the work. A 6-in. main line is also laid to opposite side of the work to deliver air to the engines of two cableways on that side. In all, 35,000 ft. of pipe is required to convey air from the central plant to the different parts of the work. This large amount of pipe is entirely exposed to the weather, but the whole air distributing system has been operated during the coldest weather. Reheaters have to be used on all air-consuming units, however, and in the winter fires are maintained at different points along the supply line to prevent the water of condensation from freezing and stopping the pipes.

Rock Excavating and Handling.—The depth of the rock cutting varies from nothing at each end of the 8,600-ft. cut to as much as 27 ft. at the middle of the latter, with an average depth of 15 to 16 ft. The rock has mostly all been taken out in two lifts, the faces being

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worked the full width of the cut. Four steam shovels and four cableways have been used, one shovel to each cableway. Generally, the shovels have been worked in pairs, one shovel removing the top lift, and being followed by the other working on the second lift. The work has been handled in two lifts in this manner, in order that the sides of the cut could be made vertical with channeling machines. Four of these machines have been used, two Sullivan and two Ingersoll-Sergeant, all of which are capable of cutting to a depth of 14 ft. The specification provided payment for the removal of the sides of the excavation to a slope of 1 on 1, but stipulated that the contractor would be paid for all excavation out of these slopes, if the sides of the cut were channeled, which has been done accordingly.

The holes for the blasts necessary to break up the hard rock are made with 3¼-in. Rand drills, 30 of which are installed. The holes are made in two or three rows, depending on the character of the rock and other cicumstances. Owing to the nature of the rock, the blast holes have to be placed at the four corners of 4 x 6-ft. or 5 x 5-ft. squares, making the cost of blasting very high. Half of the face of the cut is shot at a time, in order that the drills may be working on one half while the shovel is removing the muck from the other half. Dynamite is used for blasting, which is done almost entirely in the daytime.

The four steam shovels used in loading the loosened rock into the cableway skips are specially adapted to working in the cut. They are Model 60 Marion shovels, each with a 26-ft. boom carrying a 2½-yd. bucket. Each shovel is equipped with a traction gear which is capable of propelling it on wheels with 30-in. tires, without track, the same as the Model 20 shovel made by the same company is propelled. The driving gear is attached to the front wheels, the 16-in. steel axle of which is fixed, the steering being done with the hind wheels, which are on a pivoted axle. The shovels move on the rock bottom of the cut back and forth along the face without difficulty and can make a complete turn to start work in the opposite direction in 15 to 18 minutes. At rare intervals the shovels become stalled on rough bottom, or toward the ends of the cut where the rock runs out. The fall blocks of the cableway serving the shovel are then fastened to the front or the rear end of the latter, which can thus be helped along over the bad spot without any trouble.

The boilers of the shovels are all supplied with water from a pump in the plant midway on the cut which houses the boilers supplying steam to the 8-in. and 12-in. reciprocating pumps in that plant. A 2-in. exposed pipe line, extending to both ends of the work from this plant has been able to supply water to the shovels and to hoisting engines for the derricks that are installed during the coldest weather by a method of operation which has been developed since the work was started. A 5,000-gal. circular wooden tank is placed in the boiler room of the plant and is heated during cold weather by the exhaust steam from the 8-in. and 12-in. pumps. Either of the two pumps on the supply line to the shovels and derricks draws from this tank, the steam exhaust of the pump in service being turned into the suction pipe of its water end. The temperature of the water is thus raised to about 100° Fahr., by the exhaust from the three pumps, so it does not fall below the freezing point before reaching the shovels and derricks even during the most extreme weather, due to a method of operation that has been adopted. When a shovel engineer needs water he can ring an electric bell in the pump house. The pump is then started and run until the engineer signals again, when it is shut down. The water left in the pipe leading to the shovel is then immediately blown out under a pressure of 90 lbs., with air from the compressor supply line, and the pipe closed until water is required again. Arrangements were made to use steam to thaw the pipes after the water has been drawn from them, but the steam has never been necessary, as the distributing pipes are free from ice at all times.

An interesting condition developed in connection with the operation of the air line used to blow out these 2-in. water supply pipes. Shortly after the 2-in. air line for blowing the water pipes was installed it became difficult to maintain the usual pressure in the main air lines. Investigations determined that, on the average, the 2-in. water supply pipes required air about 7 hours out of the 24 hours, so a large amount of air was thus consumed. A plate with a ¼-in. circular hole was then placed in the 2-in. air supply line to the pump, in order that no air might be wasted. The result was that the pressure in the main air lines was at once restored, although the water could be blown out of the supply line as efficiently as before.

The four cableways are worked in two pairs, one pair operating from a point near the middle of the cut to the downstream end of the latter, and the other pair from the middle to the upstream end. The specifications were written with the idea that the channel may eventually be widened on the east, or island side. Accordingly, the material from the excavation can be dumped in the river adjacent to the improved channel, so long as the spoil banks within 300 ft. of the east side of the latter are not higher than the top of the retaining wall along that side of the cut. On the west side of the channel, the spoil banks are permitted to come within 50 ft. of the cut and the space between them and the latter can be filled to the level of the top of the wall. Owing to the nature of the river bed and bank on the west side of the cut for about 3,600 ft. from the upstream cofferdam, head towers for traveling cableways could not be operated with any degree of safety or satisfaction. The ground on the island side of the upper end of channel was satisfactory for the operation of the head tower, however, so cableways long enough to span the 300-ft. channel cut, the 300-ft. berm along the latter and sufficient space for spoil banks between the edge of this berm and the head towers had to be installed. At the downstream end of the channel conditions were much more favorable for the operation of head towers on the mainland side of the river, permitting shorter-span cableways to be installed.

The four cableways were made by the Lidgerwood Mfg. Co.; the two upstream ones have spans of 1,100 ft. each and the two downstream ones, spans of 800 ft. each. The capacity of the cableways is probably best illustrated by the loads which they have carried regularly in service. The stone which is being removed from the cut is very dense, weighing about 4,600 lbs. to the yard; pieces of this stone containing 6 to 8 cu. yd. have been lifted out of the excavation, however, and conveyed to the spoil banks without any apparent difficulty. The head and tail towers are all mounted on trucks traveling on rails parallel with the cut. These towers have a clear height of 103 ft. above the base of rail, each pair of towers containing 85,000 ft., board measure, of timber. The front end of each tower of the 1,100-ft. span cableways is carried by seven pairs of wheels, three pair in a group under each corner and one pair on the center line. Seven more pair of wheels are placed under the rear legs of the tower and are spaced the same as those at the front end of the latter. Three lines of rails laid under the counterweight end of the tower platform carry eight pairs of wheels, staggered alternately so each outer rail of the three carries four wheels and the middle one eight. As compared with the usual arrangement of wheels for a cableway tower, in this case an extra pair is added under each leg of the tower and a pair under the middle of each side of the tower platform. The

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great load on the wheels and rails is thus distributed in such a way that bending of the rails is prevented. The tracks for the 800-ft. span cableways are the same as those just described except they have five pairs of wheels in a row where the others have seven. A 50-H. P. moving engine is provided on each tower.

Each cableway is operated by a double 12¼ x 15-in. engine driving a 59-in. hoisting drum, all in a house on the head tower. This engine gives the carriage a hoisting speed of 250 ft. and a traveling speed of 1,200 ft. a minute. The section of the hoisting drums carrying the endless cable line is covered in each case with a rim of boiler plate steel which wears much better than the regular material in the drum and can be replaced readily when worn. The carriage of each cable is equipped with an extra block, and an increased diameter section is added to the hoisting drum of the engine, so the skips can be dumped in the air by the hoisting engineer. This aerial dumping device was invented by Mr. Locher during the progress of the work on the Chicago Drainage Canal, and is the one which has been in general use since then.

A 2¼-in. lock-bar cable, made by the Trenton Iron Works, is used on the main cable in each machine. The repairs to the lock-bar cables have been very much simplified since the inception of the work, until now all minor repairs and some rather extensive ones are made without lowering the cable. When a strand breaks the ends at the break are lapped about ½ in. and are filed down on a bevel to form a flat joint, as nearly as possible. This is wrapped with fine brass wire, then covered with a little borax and heated to the welding point with a blow torch. The brazed joint is then filed down to the same cross section as the remainder of the strand, in order that the latter may be driven back into place. In case the ends at a break are not long enough to lap, a piece is cut out of the strand and another piece long enough to lap is welded in its place. Small steel clamps with tightening screws are placed around the cable to hold the loosened strands in position while the repairs are being made and to assist in replacing the mended strands.

The repairs to the cables and cableway carriages are greatly facilitated by small cabins erected over the ends of the cables at the head towers. During the extremely low temperatures which occur in the winter it would be practically impossible to make repairs on these towers, 100 ft. or more above the ground without some such protection, and even with the latter men are often frost-bitten.

The skips used in connection with the cableways have a capacity of 6 cu. yd. each. They are built of heavy steel plates, but the extremely hard rock which is handled into them with the steam shovels breaks and bends them very quickly, 35 of these skips having been used in this work.

Retaining walls varying from 5 to 20 ft. in height and having a minimum top width of 5 ft., are built along both sides of the channel for a length of 5,000 ft. The tops of the walls are 6 ft. above extreme low water, the walls being built as a guide to traffic. They have been built of large stones taken from the cut, many of these stones containing 2 to 6 cu. yd. The limestone through which the channel cut is being made is quite evenly stratified and breaks out in regularly shaped pieces. At points where the stone occurred in particularly uniform strata, areas were reserved from the general excavation in order that the rock might be quarried carefully out of these areas for use in the walls. Four stiff-leg derricks operated by steam-driven hoisting engines, are used in handling the stone in these small quarries and in building the wall. With the exception of these four hoisting engines, the steam shovels and three pumping plants, all of the equipment on the work is operated on air from the central compressor plant.

The work within the cofferdams is now rapidly approaching completion. The rock cut is finished up to within a short distance from each end, the excavation having been carried to and below the required grade, and the bottom finished as the work progressed. The excavation had to be carried below the grade in places in this manner in order that the steam shovels could follow the plane of the inclined strata which occur in the rock. The retaining walls along this cut are practically done. A small amount of earth excavation between each end of the rock cut and the main cofferdam will be taken out with the steam shovels and conveyed to the spoil banks by the cableways. When this is finished and the work has been cleaned up it is planned to admit the water into the area enclosed by the cofferdams very slowly to prevent any of the loose material being washed into the channel. The portion of the cofferdams across the channel and the small portion of the channel in earth between the ends of the rock cut and the cofferdams will then be removed with a dredge.

The progress that has been made in executing this work is well worthy of notice. As has been mentioned the first work was started early in the summer of 1904, but it was early in the summer of 1905 before the whole area enclosed by the cofferdams was unwatered. Therefore, practically all of the work will be done in two and one-half years; at the same time, it should be borne in mind that the time limit on the work does not expire until Aug. 18, 1908, or in other words, the contract will be completed nearly a year ahead of time.

The quantities of materials handled by the plant installed also merit attention. During the month of June, last, the four cableways and four steam shovels handled approximately 86,000 cu. yd. of rock, or an average of 21,500 cu. yd. to each shovel and cableway. The output for July will be approximately the same amount. The monthly output since the four shovels and four cableways have been installed has ranged in the neighborhood of 65,000 cu. yd. In this connection it is interesting to observe that the output of the cableways used most successfully in rock cuts on the Chicago Drainage Canal ranged in the vicinity of 8,000 cu. yd. a month when operated an eleven-hour day shift. At the same time, the rock in that work was much more easily blasted and was not so hard on plant as is the rock which has been encountered in this contract.

Another significant feature of the operations on this work is that the number of skips of stone handled at night by the cableways is about the same as the number handled in the day time. This condition may probably be attributed to two principal causes, the lighting and the efficient method of inspection and repairs which is followed. The method of inspection and repairs is also largely responsible for the maintenance of operations so successfully during the winter.

The lighting in the field is done with portable Kitson gasoline lamps, enough of which are used so all operations can be carried on without interference. The blasting is practically all done during the day, but when any blasting has to be done at night the lamps can very readily be moved out of range.

The method of inspection and repairs that is followed is very thorough. In the first place, the whole work is so far isolated from a base of supplies that a very large amount of extra parts and materials for repairs are kept on hand constantly. For instance, an extra steam shovel dipper, a dipper arm, one of the heavy traction gears and shaft, and so forth, are always ready for use. The small parts of the various machines are also kept in quantities in a supply house, the total quantity of ex-

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tras and repairs on hand representing about $20,000. The parts of each machine which are most liable to need replacing, such as the cableway sheave wheels and the like, are kept at the machine in order to save the delay necessary to bring extras from the supply house. A blacksmith and machine shop in which most repairs can be made is also provided. The second feature of this maintenance system is the inspection method followed. A mechanic and helper are placed in charge of each two cableways, the carriages of which are carefully inspected at meal hours, or at other times when they are brought to the head towers. Any necessary repairs are made then, if possible, but if it is impracticable, they are delayed until a more favorable time. The steam shovels are also under the constant supervision of a mechanic, whose sole duty is to go over the shovels daily in an endeavor to find any defective parts. That this unusually close system of inspection has proved profitable, is evident from the rapid progress which has been made.

The supplies for the three camps which the contractor built and maintained on the mainland at the work are brought from Sault Ste. Marie by boat during the open navigation season, and over land in sleighs the balance of the year. Coal to operate the various plants and for the camps is delivered entirely by boat, enough being brought in each summer to last through the winter. Thus far, in the neighborhood of 40,000 tons of coal has been used. The majority of this has been required in the compressor plant. A road was built through the dense timber along the river by the contractor and such coal as is used at points where delivery is not made by boat is hauled along this road in wagons.

The improvement of the West Neebish channel is being carried on under the direction of Col. Chas. E. L. B. Davis, Corps of Engineers, U. S. A. Mr. L. C. Sabin is assistant engineer, Corps of Engineers, U. S. A., with headquarters at Sault Ste. Marie, Mich., and has charge of all construction and administration of the navigation in the St. Mary's river. Mr. Sutton Van Pelt is in immediate charge of the work under Mr. Sabin. Mr. A. S. Robinson is local manager of the Sault Ste. Marie office of the MacArthur Bros. Co.

DREDGING IN BOSTON HARBOR.

The entire contract for dredging the 35-ft. channel in Boston harbor, involving an expenditure of $3,096,000 has been let to G. H. Breymann & Bros., Toledo. The present 35-ft. channel extending from Chelsea bridge and Charles river bridge to President Roads will be increased to a maximum width of 1,200 ft. and the present 35-ft. channel from President Roads to the sea at Broad Sound will be increased to 1,500 ft.

BREAKWATER AT OSWEGO.

Abstract of bids for constructing 1,175 linear feet stone-concrete superstructure on breakwater at Oswego, N. Y.:

Barnett Contracting Co., Oswego, N. Y., Total	$400,027.50
Patrick Keohane, Fayetteville, N. Y., Total	339,287.50

REMOVING WRECK OF TUG M'CORMICK.

Abstract of proposals for removing wreck of tug McCormick in Grand River, Fairport Harbor, Ohio, received and opened by Lieut. Col. C. McD. Townsend, Corps of Engineers, at Cleveland, O., on August 6, 1907, in accordance with advertisement dated July 22, 1907:

Name and Address of Bidders.	Amount Bid for Removing the Wreck.
Harris W. Baker, Detroit, Mich.	$1,000.00
Chas. R. Dittrick, Cleveland, O.	1,400.00
*Walter V. Metcalf, Cleveland, O.	270.00
Eugene Boehm, Atlantic City, N. J.	1,382.00
A. Levine, Cleveland, O.	1,465.00
Great Lakes Construction Co., Buffalo, N. Y.	1,399.00

*Awarded contract.

DREDGING IN DELAWARE RIVER.

Abstract of proposals for dredging in Delaware River at Perriwig Bar, received in response to the advertisement and specifications dated July 12, 1907 issued by Major J. C. Sanford, Corps of Engineers, and opened August 12, 1907:

No.	Name and Address of Bidder.	Price per cu. yd., place measurement.
*1	American Dredging Co., Phila., Pa.	33c.

*Awarded.

DREDGING CHEBOYGAN HARBOR.

Abstract of proposals for dredging at Cheboygan Harbor, Mich., received in response to advertisement dated July 16, 1907, and opened Aug. 15, 1907, by Col. Chas. E. L. B. Davis, U. S. Army:

Name and Address of Bidder.	Price per cu. yd.
H. W. Hubbell & Co., Saginaw, Mich.	57c.
Great Lakes Dredge & Dock Co., Chicago, Ill.	42c.

REPAIRING NORTH PIER AT HOLLAND.

Abstract of bids for repair of North Pier at Holland, opened July 26, by Col. M. B. Adams, Grand Rapids, Mich.:

1.	Bennett-Schnorbach Co., Muskegon, Mich., Total	$33,843.75
2.	Burk, Smith & Nelson, Muskegon, Mich.	35,716.14

QUESTIONS ANSWERED.

Is the following a correct definition of deviation of the compass: "The deviation of the compass needle is that attraction caused by the iron or steel in the ship, causing the needle to deviate from its true course." I am much interested in your answer.

A SUBSCRIBER.

Ans.—Deviation is not caused by an attraction, it is due to a magnetic disturbing force, such as the combined magnetism of a ship—hull and equipment. A compass needle has two ends so that when one of its ends is attracted the other must be repelled. The needle deviates from its magnetic course and not from its true course, that is, if true course is taken in its navigation sense instead of figuratively. The definition should have read thus: "The deviation of the compass needle is that disturbance caused by the ship's magnetism, causing the needle to deviate from its natural direction in the magnetic meridian."

CHANGE OF TITLE.

The name and title of the James Reilly Repair & Supply Co. has been changed to The Griscom-Spencer Company. The company operates works at Jersey City, foot of Grand and Sussex streets, adjoining Pennsylvania railroad terminal and at Philadelphia, foot of Washington avenue, comprising machine shop, boiler shop, carpenter shop, brass foundry, coppersmithing, pipe fitting, electrical work, armature winding, painting shop, etc., for installations and repairs of every character to ships or other floating property, power plants and stationary work, and the manufacture of feed water heaters, evaporators, condensors, grease extractors and other specialties. The company also maintains a supply house at 229-230 West street, N. Y., fully equipped for the furnishing of supplies and outfit of every description to steamships, yachts, power plants, contractors, builders, etc. The general offices are in the new West Street building, No. 90 West street, N. Y.

DREDGING IN WOODBRIDGE CREEK.

Abstract of bids for dredging in Woodbridge Creek, N. J., opened July 27 by Col. D. W. Lockwood. Amount available about $16,000.

I. M. Briggs, 154 Nassau St., New York City	28 8-10c. per cubic yd., scow meas.
John & Joseph McSpirit, 118 Wayne St., Jersey City, N. J.	33 c. per cubic yd., scow meas.

DREDGING IN NEWARK BAY.

Abstract of bids for dredging in Newark Bay and Passaic River, N. J., opened July 30 by Col. D. W. Lockwood. Continuing contract. Amount at present available about $200,000.

Midland Land & Improvement Co., 62 Cedar St., New York City	16¼ c. per cubic yd., scow meas.
Morris & Cumings Dredging Co., 17 State St., New York City	23 2-10c. per cubic yd., scow meas.
P. Sanford Ross., Inc., 277 Washington St., Jersey City, N. J.	36 4-10c. per cubic yd., scow meas.
The International Contracting Co., 17 Battery Place, New York City	26 c. per cubic yd., scow meas.
The W. H. Beard Dredging Co., 21 State St., New York City	22 9-10c. per cubic yd., scow meas.

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FLEET TELEPHONY.*

BY COM. BRADLEY A. FISKE, U. S. NAVY.

In 1895 I went, unofficially, on board one of our new battleships, at anchor off Staten Island. I got into conversation with the captain on the quarter deck, and after awhile the conversation turned to the subject of fogs. Something betrayed me into the indiscretion of suggesting the scheme I am about to describe. I had had the idea in my head for a long time, but had not dared to mention it.

The captain did not understand my plan for a few moments; but when he did, he raised both hands above his head and disappeared down the cabin hatch.

The scheme I suggested was that, when an admiral saw a fog coming up he should make a signal, in obedience to which the ships should form exact column; and each ship should pay out over the stern an insulated wire supported by a buoy, which buoy should be picked up by the ship astern, and the wire connected to the end of a permanent wire which should run the length of that ship to the inboard end of the wire which that ship paid out astern. This permanent wire was to be part of a circuit, including a separate battery for each ship, and two sets of telephones, one set placed in the chart house, and the other in the cabin. In order to prevent the breaking of the wires between the ships, I suggested that the wire paid out astern should be about 800 yards long, and that the spare wire at the end should be put around a reel in the bow of the ship astern, which should automatically reel in the wire, or pay it out like a small towing engine. I pointed out that this wire could have marks on it; and that by noting these, and the direction in which the wire tended, one could tell the distance and direction of the ship ahead in the thickest fog with extreme accuracy. I also pointed out that, even if a wire broke between any two ships, the ships on each side of the break could still talk together; and that the ship astern of which the wire broke could pay out another wire in a few minutes.

Since that time I have suggested the scheme occasionally, but have never got anybody to endorse it, until now. But I have just received a letter from Commander Oliver, suggesting the plan himself, saying that he proposed it to Admiral Manney in 1903, and asking me if I could not see my way to testing it. As I cannot, it occurs to me that a suggestion in the Naval Institute may reach somebody who can.

*From the proceedings of the United States Naval Institute, copyrighted.

Last summer, when in command of the Minneapolis off Virginia Beach, I tried the plan in a crude way between the Minneapolis and a steam launch. The plan worked very well for about five minutes, during which time the Minneapolis and the steamer were going about five knots, the steamer about 300 yds. astern. There being no reel available for the wire, a man sat in the bow of the steamer and held the wire in his hand, having about 10 fathoms slack in the steamer, and paying out or hauling in the wire, in such a way as to keep a short slack bight under the bow of the steamer. Of course, the friction of the wire in the water kept it taut in the water; and the man in the steamer simply held up the slack wire running from his hand directly down to the water, so that there was no strain on the wire, except that due to friction in pulling it through the water. But the wire was a condemned length of portable wire, about No. 16, and it had been broken in several places and spliced; therefore, it was not at all suitable for the experiment, and it soon broke.

Last September in New Haven, just before going to the Oyster Bay review, I described this experiment to Commander Colwell of the Denver, and asked him if he would not try it between the Minneapolis and the Denver after the review was over. He consented; and after the sixth division was broken up by signal, the Denver came up astern of the Minneapolis and received an electrician whom I sent on board with two telephones. We then paid out the same spliced wire that had been used off Virginia Beach, which I had endeavored to re-enforce by seizing it at frequent intervals to a piece of signal halyard stuff. This did not work at all well; because, after the Denver had picked up the buoy, the seizings slipped, and the wire and halyard stuff got into a bad tangle. The Denver got the wire at length, however, and we steamed ahead at 400 yds. distance; but no sound could be heard through the telephones. The wire had broken again.

The trouble was clearly the mechanical weakness of the wire; and it occurred to me to see if the halyard stuff would stand the strain; arguing that, if it could, an electric wire could, provided it were as strong as the halyard stuff. So I steamed ahead at 10 knots, the Denver following, and there was no trouble whatever, and the piece of halyard stuff at no time had much strain on it. At the end of twenty minutes nothing had happened, and the experiment was stopped.

Now, if the Minneapolis and Denver could steam this way for twenty minutes, why could they not do it for twenty hours? And if two ships could do it, why not eight? And if they could steam this way, using a piece of signal halyard stuff, why could they not do it using a wire?

I submit this scheme simply as a suggestion. I do not advocate battleships being fitted with it, at once; and I can see that many objections may be made to it, and some difficulties met, in reducing it to practice. At the same time, it may be pointed out that many things seem impracticable at first sight, especially if they are novel, which are not impracticable at all; and which need simply a little patient experiment in overcoming "bugs" in the apparatus, and a little patient drill in using that apparatus.

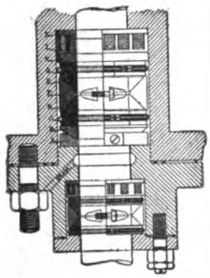
It is easy—fatally easy sometimes—to condemn a new idea as "impracticable," and toss it aside; but it is harder to formulate a definite and logical objection to it. Now, what definite and logical objection can be formulated against this plan? Why should it not be tried? It can be tried very cheaply and very easily.

If we had any plan now by which ships could steam together in a fog safely, we might be very haughty in regard to suggested schemes; but we have not. No ship knows where any other ship is, or what she is doing; and if it becomes necessary to change course or speed, or if any ship gets even partially disabled, all hands are in peril, principally because of the extreme liability of misunderstanding the steam whistle signals, and the long time required to get them down the column and back to the flagship. It is true that wireless telegraphy can be used for making signals in a fog; but an important dispatch may be coming in just at the time when a change of course is to be made; and furthermore, it is an accepted principle that wireless telegraphy should not be used for signaling among the vessels of a fleet, when it can be avoided, because such a use would not be practicable in war. But if the plan herein outlined can be developed, communication among the ships will be perfect, much better than by wireless; and the admiral can give orders as to changing course or speed which cannot be mistaken by his captains, or picked up or interfered with by the enemy.

One important feature may be insisted on—that, even if some accident should occur in a fleet in a fog using this plan, and even if it should become necessary to let go the connecting wires, no harm would result, and the fleet would be just as it is now.

The steamer Northern King struck an obstruction out of Duluth harbor and damaged her bottom. She had to lighter part of her cargo to make repairs.

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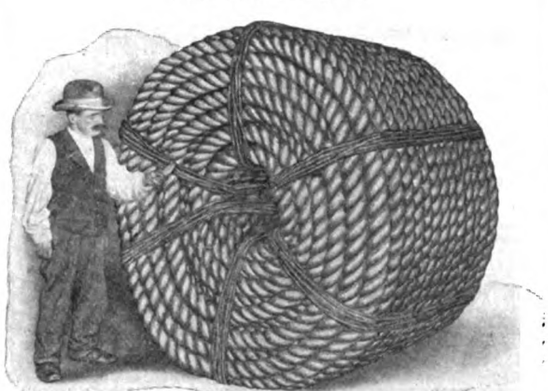
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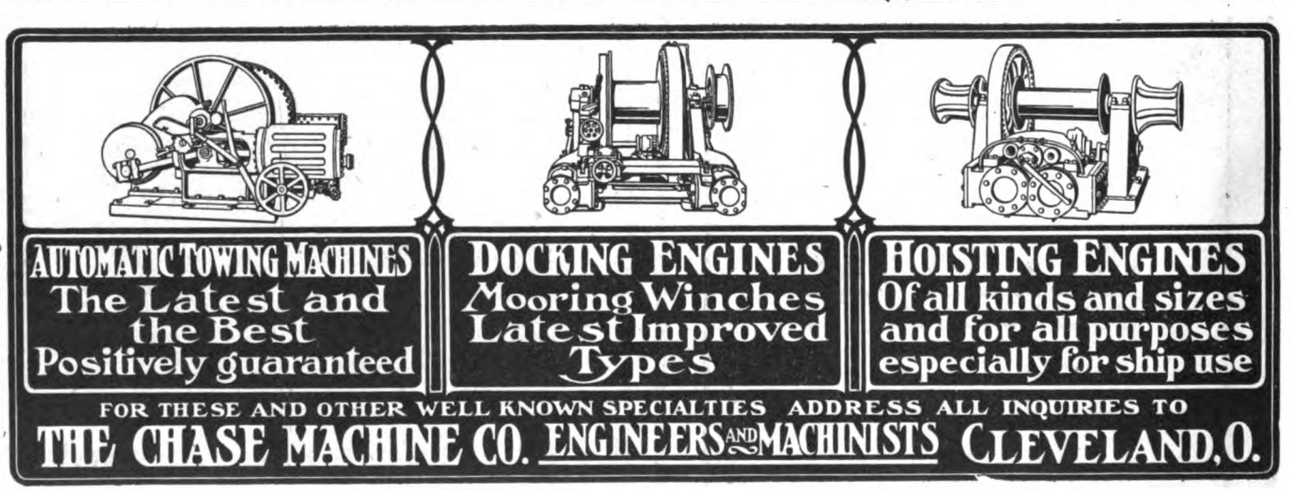
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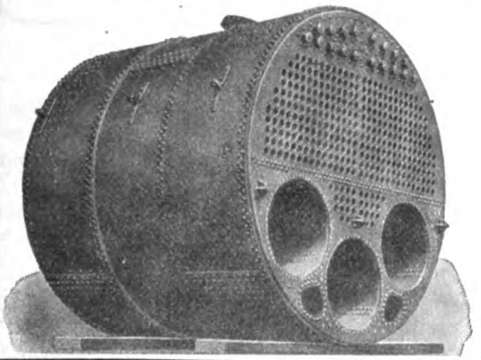


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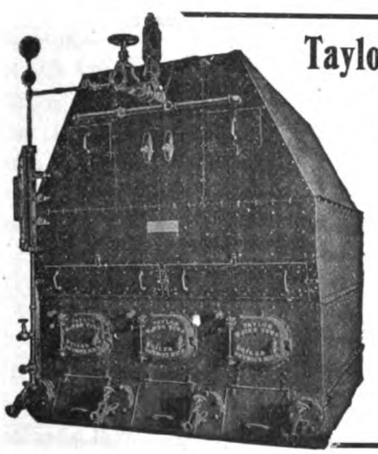


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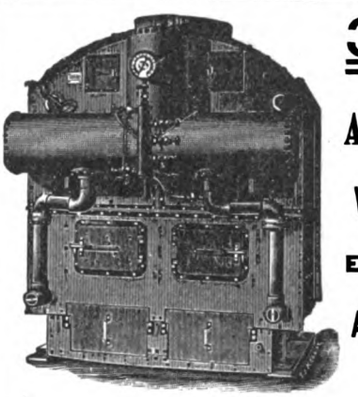


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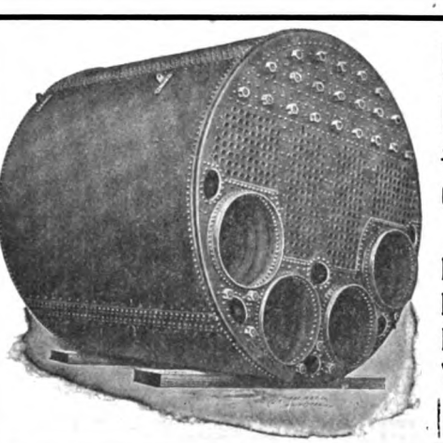
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PROPOSALS.

PROPOSALS FOR CONSTRUCTING breakwater. U. S. Engineer Office, 813 Prospect Ave. S. E., Cleveland, Ohio, August 10, 1907. Sealed proposals for extension of west breakwater at Fairport Harbor, Ohio, will be received at this office until 2 P. M. Standard Time, September 10, 1907, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office. C. McD. Townsend, Lieut. Col., Corps of Engineers, U. S. A.

PROPOSALS FOR CONSTRUCTING breakwater. U. S. Engineer Office, 813 Prospect Ave. S. E., Cleveland, Ohio, August 10, 1907. Sealed proposals for extension of the east breakwater at Cleveland Harbor, Ohio, will be received at this office until 2 P. M. Standard Time, September 10, 1907, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office. C. McD. Townsend, Lieut. Col., Corps of Engineers, U. S. A.

U. S. Engineer Office, Milwaukee, Wis., Aug. 2, 1907. Sealed proposals for removing old pier, building pile pier, dredging, etc., at Two Rivers Harbor, Wis., will be received here until 2 P. M. September 3, 1907, and then publicly opened. Information furnished on application. W. V. Judson, Major, Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., August 6, 1907. Sealed proposals for hire of dredging plant for use in Detroit River will be received at this office until 3 p. m., August 26, 1907, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col., Engrs.

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